NASA/SP—1999–7037/SUPPL401
May 28, 1999

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Typical Report Citation and Abstract

❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
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9. Subject Terms

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 401)

MAY 28, 1999

01
AERONAUTICS

19990036165 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 399
Apr. 30, 1999; 56p; In English
Report No.(s): NASA/SP-1999-7037/SUPPL399; NAS 1.21:7037/SUPPL399; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.

Author

Aeronautical Engineering; Bibliographies; Data Bases

19990036191 Research and Technology Organization, Applied Vehicle and Technology Panel, Neuilly-sur-Seine, France
Fluid Dynamics Research on Supersonic Aircraft ***Les Travaux de Recherche en Dynamique des Fluides Relatifs aux Aeronefs Supersoniques***
November 1998; 332p; In English, 25-29 May 1998, Rhode-Saint-Genese, Belgium; See also 19990036192 through 19990036210
Report No.(s): RTO-EN-4; AC/323(AVT)TP/6; ISBN 92-837-1007-X; Copyright Waived; Avail: CASI; A15, Hardcopy; A03, Microfiche

The paper contains the lecture notes prepared for a Special Course on 'Fluid Dynamics Research on Supersonic Aircraft' organized by the RTO Applied Vehicle Technology Panel (AVT). The Course was held at the von Karman Institute for Fluid Dynamics (VKI) Institute, Rhode-Saint-Genese, Belgium 25-29 May 1998. The following topics were covered: History & Economics of Supersonic Transports, Supersonic Aerodynamics, Sonic Boom Theory and Minimization, Multi-Point Design Challenges, Vortex Plume Interactions, Propulsion System Design. Presentations on the major world wide supersonic transport programs were also included. The material assembled in this publication was prepared under the combined sponsorship of the RTO Applied Vehicle Technology Panel, the Consultant and Exchange Program of RTO, and the von Karman Institute (VKI) for Fluid Dynamics.

Author

Supersonic Transports; Fluid Dynamics; Supersonic Aircraft; Lectures; Aircraft Design; Aerodynamics

19990036552 Logistics Management Inst., McLean, VA USA
Aviation System Analysis Capability Executive Assistant Analyses ***Final Report***
Roberts, Eileen, Logistics Management Inst., USA; Kostiuk, Peter, Logistics Management Inst., USA; March 1999; 42p; In English
Contract(s)/Grant(s): NAS2-14361; RTOP 538-16-11-01
Report No.(s): NASA/CR-1999-209118; NAS 1.26:209118; NS801S3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document describes the analyses that may be incorporated into the Aviation System Analysis Capability Executive Assistant. The document will be used as a discussion tool to enable NASA and other integrated aviation system entities to evaluate, discuss, and prioritize analyses.

Author

Systems Analysis; Air Transportation; National Aviation System; Models; Computer Aided Design

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19990032465 NASA Langley Research Center, Hampton, VA USA
Aerodynamic Parameters of High Performance Aircraft Estimated from Wind Tunnel and Flight Test Data
Klein, Vladislav, George Washington Univ., USA; Murphy, Patrick C., NASA Langley Research Center, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 18-1 - 18-20; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A concept of system identification applied to high performance aircraft is introduced followed by a discussion on the identification methodology. Special emphasis is given to model postulation using time invariant and time dependent aerodynamic parameters, model structure determination and parameter estimation using ordinary least squares and mixed estimation methods. At the same time problems of data collinearity detection and its assessment are discussed. These parts of methodology are demonstrated in examples using flight data of the X-29A and X-31A aircraft. In the third example wind tunnel oscillatory data of the F-16XL model are used. A strong dependence of these data on frequency led to the development of models with unsteady aerodynamic terms in the form of indicial functions. The paper is completed by concluding remarks.
Author
System Identification; Unsteady Aerodynamics; Supersonic Aircraft; Fighter Aircraft; Mathematical Models; Aircraft Design; Aerodynamic Characteristics

19990032471 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
Study of a Rotor Flap-Inflow Model Including Wake Distortion Terms
Krothapalli, Krishnamohan R., Georgia Inst. of Tech., USA; Prasad, J. V. R., Georgia Inst. of Tech., USA; Peters, David A., Washington Univ., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 26-1 - 26-10; In English; See also 19990032449; Sponsored in part by Georgia Tech./Washington Univ. Center of Excellence in Rotorcraft Technology; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

For many years, analysts have been puzzled by the fact that the off-axis coupling of a helicopter exhibits the opposite sign in flight tests as compared to simulations. Recently, researchers have shown that the effect may be attributable to the bending of the wake during a pitching maneuver, which introduces a fore-to-aft gradient in induced flow that can reverse the predicted sign of the roll coupling. Other research has shown that this result can also be obtained with momentum and vortex theory. There are many issues still under debate regarding the magnitude of wake distortion and its effectiveness in predicting off-axis dynamics. In the present work, a generalized dynamic wake model is augmented to include wake distortions. This model is then coupled with a flap model for simulation in low speed forward flight. Frequency responses from the simulation are collected with and without wake distortion, and these are compared with wind tunnel test data.
Author
Mathematical Models; Helicopters; Dynamic Models; Data Processing; Simulation; Flapping; Flight Control

19990032475 Scientific and Technical Research Council of Turkey, Defense Industries Research and Development Inst., Ankara, Turkey
Aerodynamic Data Identification Using Linear Aeroballistic Theory
Mahmutyazicioglu, Gokmen, Scientific and Technical Research Council of Turkey, Turkey; Platin, Bulent E., Middle East Technical Univ., Turkey; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 30-1 - 30-12; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The history of the linear aeroballistic theory extends to 1920's to Fowler et al. It has been used widely in aeronautical studies for estimating aerodynamic parameters till 1970's when numerical and analytical methods like Chapman-Kirk Kalman filter techniques had been discovered. Today linear aeroballistic theory is still used to get an initial estimate to more complex methods. This is due to its simplicity and ease of application. In this paper, a new formulation, which uses the linear aeroballistic theory to estimate the aerodynamic data, will be presented. Result of the test cases obtained with this formulation will be given.
Author
Parameter Identification; Ballistics; Aerodynamics; Euler Equations of Motion; Systems Engineering; Estimating; Mathematical Models; Computer Programs

19990035827 Virginia Polytechnic Inst. and State Univ., Interdisciplinary Center for Applied Mathematics, Blacksburg, VA USA
A Sensitivity-Based Design Environment ***Final Report, 1 Feb. 1998 - 31 jan 1999***
Burns, John A.; Jan. 31, 1999; 14p; In English; Original contains color plates
Contract(s)/Grant(s): F49620-98-1-0246
Report No.(s): AD-A360960; ICAM-99-02-01; AFRL-SR-BL-TR-99-0080; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains a summary and highlights of the work funded by the Air Force under AFOSR Grant F49620-98-1-0246, titled ”A Sensitivity-Based Design Environment”. This effort, funded under the Defense University Research Instrumentation Program (DURIP), was conducted by the Center for Optimal Design and Control (CODAC), at Virginia Tech during the period 1 February 1998-31 January 1999. The objective of the grant was to assemble the computational facilities to implement a sensitivity-based design environment. In recent years researchers at CODAC have developed mathematical foundations and a computational framework for the rapid calculation of design-sensitivities for aerospace applications. Implementation requires approximate solution of certain linear partial differential equation. In aerodynamic applications, for example, these solutions describe in linear approximation how the flow will change with a given change in a (geometric) design parameter. We have acquired an SGI Origin 2000 computer with 16 processors and two SGI Octane workstations to provide the computational platform for these calculations.
DTIC
Computer Aided Design; Computational Fluid Dynamics; Workstations; Sensitivity; Optimal Control; Design Analysis; Assembling

19990035997 Air Force Research Lab., Propulsion Directorate, Wright-Patterson AFB, OH USA
Aerodynamic Effects on Mistuned Response of a High-Speed, Low Aspect Ratio Fan ***Final Report, 1 Dec. 1996 - 9 May 1998***
Kenyon, James A.; Fleeter, Sanford; Oct. 1998; 172p; In English
Contract(s)/Grant(s): Proj-3066
Report No.(s): AD-A360843; AFRL-PR-WP-TR-1998-2118; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Blade response to an inlet total pressure distortion was measured in a integrally bladed disk, or blisk. Blade-to-blade variations in blade resonant frequencies, know as mistuning, and how these variations are related to vibratory stress amplitude and viscous damping variations were investigated. In addition, a reduced-order analytical model was used to predict the blade resonant stress variations based on the frequency variation measured in the blisk. The measured stress variations were found to be strongly influenced by unsteady aerodynamic coupling. Blade structural mistuning and mechanical coupling through hub motion were determined to have only a minor influence on blade-to-blade stress variations. Stress distribution patterns at resonance and at constant speeds, above and below resonance suggested a relationship between stress variations and unsteady aerodynamics. to support this, aerodynamic damping variations measured at resonance were shown to roughly correspond to stress variations. Experimental results were compared to the predicted variations from the reduced-order model. Results from the model indicated that unsteady aerodynamic coupling played at important role in the mistuned response of the blisk.
DTIC
Aspect Ratio; Aerodynamic Characteristics; Fans; Blades; Resonant Frequencies; Unsteady Aerodynamics; High Speed

19990036167 NASA Langley Research Center, Hampton,VA USA
Computational Test Cases for a Rectangular Supercritical Wing Undergoing Pitching Oscillations
Bennett, Robert M., NASA Langley Research Center, USA; Walker, Charlotte E., NASA Langley Research Center, USA; Apr. 1999; 132p; In English
Contract(s)/Grant(s): RTOP 522-31-81-03
Report No.(s): NASA/TM-1999-209130; L-17830; NAS 1.15:209130; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Proposed computational test cases have been selected from the data set for a rectangular wing of panel aspect ratio two with a twelve-percent-thick supercritical airfoil section that was tested in the NASA Langley Transonic Dynamics Tunnel. The test cases include parametric variation of static angle of attack, pitching oscillation frequency, and Mach numbers from subsonic to transonic with strong shocks. Tables and plots of the measured pressures are presented for each case. This report provides an early release of test cases that have been proposed for a document that supplements the cases presented in AGARD Report 702.
Author
Computational Fluid Dynamics; Unsteady Aerodynamics; Rectangular Wings; Supercritical Wings; Wing Oscillations; Wind Tunnel Tests; Aircraft Parts

19990036193 Colorado Univ., Aerospace Engineering Sciences, Boulder, CO USA

Supersonic Aerodynamics: Lift and Drag

Seebass, Richard, Colorado Univ., USA; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 2-1 - 2-6; In English; See also 19990036191; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

We briefly review here the fundamentals of generating lift, and what this costs us in inviscid drag at supersonic speeds in the context of the optimum aerodynamic design. The supersonic area rule tells us how to determine the wave drag and this leads to the minimum possible inviscid drag for a supersonic aircraft. We understand from this, then, the trade-off between induced drag and wave drag due to lift. Finally, viscous effects are considered briefly. These determine the altitude at which the aircraft will fly and this sets its C(L) and thereby its aerodynamic performance.

Author

Induced Drag; Lift; Supersonic Aircraft; Supersonic Speed; Viscous Flow; Aerodynamic Configurations; Aircraft Design; Oblique Wings

19990036199 Florida Univ., Graduate Engineering and Research Center, Shalimar, FL USA

Vortex-Plume Interaction Research

Sforza. Pasquale M., Florida Univ., USA; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 9-1 - 9-20; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The problem of the wake of an aircraft cruising at supersonic speed in the stratosphere is presented. The two major components of the flow field are the trailing vortex wake and the jet exhaust plumes. Accurate prediction of the dispersion of engine emissions resulting from interaction between the two has important consequences for determination of wake signatures. Research in the field is reviewed to provide an understanding of the present state of the art. Synthesis of these different jet and vortex studies provides a unified global description of aircraft wakes in terms of a length scale bA/C(L), based on the span, aspect ratio, and cruise lift coefficient. A model is developed in which the jet plumes, being immersed in the trailing vortex wake downwash, are assumed to deform into twin vortices typical of jets in a cross-flow. This permits the development of the wake flow field to be assessed with the relatively simple tools of vortex filament analysis. Wakes of both conventional high subsonic and supersonic aircraft may be accommodated by this approach, as would the wakes of wing-jet combination injectors for scramjet applications. Experimental studies that would aid in the development of more accurate prediction methods are also described.

Author

Plumes; Vortices; Aircraft Wakes; Interactional Aerodynamics; Cross Flow; Jet Exhaust; Aerodynamic Coefficients; Supersonic Aircraft; Supersonic Commercial Air Transport

19990036200 NASA Langley Research Center, Hampton, VA USA

Status of NASA High-Speed Research Program

Whitehead, Allen H. , Jr., NASA Langley Research Center, USA; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 10-1 - 10-20; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper provides an overview of the NASA High-Speed Research (HSR) Program dedicated to establishing the technology foundation to support the U.S. transport industry's decision for an environmentally acceptable, economically viable 300 passenger, 5000 n.mi., Mach 2.4 aircraft. The HSR program, begun in 1990, is supported by a team of U.S. aerospace companies. The international economic stakes are high. The projected market for more than 500 High-Speed Civil Transport (HSC-F) airplanes introduced between the years 2000 and 2015 translates to more than $200 billion in aircraft sales, and the potential of 140,000 new jobs. The paper addresses the history of supersonic commercial air transportation beginning with the Concorde and TU-144 developments in the early 1960 time period. The technology goals for the HSR program are derived from market study results, projections on environmental requirements, and technical goals for each discipline area referenced to the design and operational features of the Concorde. Progress since the inception of the program is reviewed and a summary of some of the lessons learned will be highlighted. An outline is presented of the remaining technological challenges. Emphasis in this paper will be on the traditional aeronautical technologies that lead to higher performance to ensure economic viability. Specific discussion will center around aerodynamic performance, flight deck research, materials and structures development and propulsion systems.

Author

Supersonic Commercial Air Transport; Supersonic Aircraft; Supersonic Flight; Aircraft Performance; Aeronautical Engineering; Aerodynamic Characteristics; Research and Development

19990036206 Florida Univ., Graduate Engineering and Research Center, Shalimar, FL USA

Shock-Vortex Interaction Research

Sforza, Pasquale M., Florida Univ., USA; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 16-1 - 16-23;

In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Supersonic cruise aircraft generate shock waves and vortices as a consequence of the flight speed and the forces generated, respectively. Interactions between these two produce flow disturbances which affect aircraft performance, stability, and control. Research in the field is reviewed to provide an understanding of the state of the art. The important parameters in the interaction are the Mach number and the swirl to axial velocity ratio of the vortex. The phenomenon of vortex breakdown is described and a criterion for determining if a shock-vortex interaction is strong enough to provoke it is given. Models developed thus far for evaluating such interactions are presented. Experimental investigations of shock-vortex interactions are also discussed.
Author

Shock Wave Interaction; Vortex Breakdown; Supersonic Cruise Aircraft Research; Vortices; Interactional Aerodynamics; Turbulent Flow; Aerodynamic Characteristics

19990036207 National Aerospace Lab., Tokyo, Japan

Aerodynamic Research for a Second Generation SST in Japan Including Laminar Flow Control and Low Sonic Boom Design

Yoshida, Kenji, National Aerospace Lab., Japan; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 17-1 - 17-23; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The outline of aerodynamic researches on a second generation SST in Japan and results of the individual research on the supersonic laminar flow control (LFC) and the low sonic boom design are described. LFC effect was examined by the wind tunnel tests of the warped delta wing model with a LFC device, and by the numerical analysis with originally developed e(sup N) method together with a new assumption. As for the low boom technology, Darden's theory was applied for designing the aerodynamic configuration and its characteristics was investigated numerically in order to clarify the effects of nose shape and Mach number. Wind tunnel tests and Euler CFD analysis were performed for the evaluation. Further trial for improvements of lift-to-drag ratio and trim constraint is proposed with regard to real airplane design.
Author

Boundary Layer Control; Delta Wings; Laminar Boundary Layer; Aerodynamic Configurations; Aircraft Design; Sonic Booms; Aircraft Structures; Aircraft Configurations; Supersonic Flight; Supersonic Aircraft

19990036208 Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France

The Aerodynamics of the Future Supersonic Transport Aircraft: Research Activities at ONERA

Thibert, J. J., Office National d'Etudes et de Recherches Aerospatiales, France; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 18-1 - 18-25; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The paper gives an overview of the ONERA activities concerning the aerodynamics of the future supersonic transport aircraft. In a first part detailed comparisons between CFD and wind tunnel data are presented and discussed. The second part addresses the problem of the drag prediction in cruise flight conditions from wind tunnel data. Skin friction coefficients values measured in flight are compared to the results of boundary layer computations. The third part is devoted to wing designs with numerical optimisation techniques. Several examples are presented and discussed. Results concerning riblets and laminar flow control are given in a fourth part which also presents experiments carried out for attachment line contamination investigation. A quiet supersonic tunnel for basic research on supersonic laminar flows is also presented. The last part of the paper deals with activities on air intakes aerodynamics. After a brief recall of supersonic air intakes operational modes and a description of the Concorde air intake, comparisons between CFD and wind tunnel data on a generic 2D intake are presented. Basic experiments on intake internal flow are described and the problem of the internal shock control is addressed. Examples of the use of CFD for auxiliary air intakes design are given.
Author

Supersonic Transports; Aircraft Design; Supersonic Aircraft; Aerodynamic Characteristics; Aerodynamic Configurations; Boundary Layer Control; Laminar Boundary Layer; Wings

19990036210 Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia

Complex Experimental Studies of SST, Part 2, Aerodynamic Interference of Various Elements

Kharitonov, A. M., Institute of Theoretical and Applied Mechanics, Russia; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 7-1 - 7-14; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The results of complex experimental studies of aerodynamic interference of various elements of supersonic transport aircraft are presented. The objective was a detailed study of local SST aerodynamics, which was aimed at seeking the methods of increas-

ing the aerodynamic perfectness of these vehicles. The results presented include the study of interference of a schematized wing with the body, wing with engine nacelles, wing with various superstructures, and wing with engine jets. A supersonic flow around all these configurations is accompanied by complex three-dimensional flows with shock wave/boundary layer interactions, boundary layers in the regions of surface junctions, diffraction flows, etc. Capabilities of the developed measurement techniques of the own aerodynamic characteristics of various elements and the contribution of the wing, the body, and the superstructures, as well as their mutual positions, to the characteristics of their combinations. The methods of increasing the lift-to-drag ratio of SST models are shown in a number of cases. At the same time, the results presented can be used as test cases for CFD validation. Author

Supersonic Transports; Aerodynamic Interference; Supersonic Flow; Transport Aircraft; Aerodynamic Configurations; Three Dimensional Flow; Shock Wave Interaction

19990036423 Loughborough Univ. of Technology, Dept. of Aeronautical and Automotive Engineering and Transport Studies, UK

Prediction of Vortex Shedding Behind Bluff Bodies

Islam, A. K. M. Sadrul, Loughborough Univ. of Technology, UK; September 1997; In English

Report No.(s): TT-9701; ISBN 0-904947-49-1; Copyright; Avail: Issuing Activity (Dept. of Aeronautical & Automotive Engineering and Transport Studies, Loughborough Univ., Loughborough, Leicestershire, LE11 3TU UK), Hardcopy, Microfiche

A numerical study has been performed to study the unsteady flow behind a bluff body viz., a square cylinder and a v-gutter. In the case of the square cylinder, both uniform approach flow and shear approach flow are considered. The uniform flow over a square cylinder is studied using the standard k-epsilon turbulence model and three of its variants viz. the KL model, the PY model, and the D model. The performance of the D model is found to be optimum in predicting the integral parameters, suppression of spurious k value upstream of the cylinder and the fluctuation of the velocities. The shear flow around a square cylinder is studied using the standard k-epsilon model and the D model up to shear parameter S = 0.15. The Strouhal number and mean drag coefficient are unaffected by the shear but the mean lift coefficient increases with shear. The k-epsilon model predicts this variation of mean lift coefficient but the D model falls to predict this. Finally, the uniform flow over a v-gutter in an axisymmetric combustor is studied using both the standard k-epsilon model and the D model. Both the models under predict the Strouhal number by 20% from the measured value.

Author

Vortex Shedding; Bluff Bodies; Numerical Analysis; Unsteady Flow; Strouhal Number; Research

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19990035725 Federal Aviation Administration, Airport and Aircraft Safety Research and Development Div., Atlantic City, NJ USA

Mixed-Phase Icing Conditions: A Review *Final Report*

Riley, J. T., Federal Aviation Administration, USA; Dec. 1998; 54p; In English

Report No.(s): PB99-126880; DOT/FAA/AR-98/76; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The report reviews publicly available evidence bearing upon possible safety hazards due to flight in mixed-phase conditions. Recent investigations with modern instrumentation suggest that these conditions are more frequent and widespread than had been realized. However, information characterizing these conditions which is suitable for addressing questions of aviation safety is very limited.

NTIS

Aircraft Icing; Ice Formation; Flight Conditions; Flight Safety; Hazards; Mixed Crystals

19990035726 Federal Aviation Administration, Washington, DC USA

Notices to Airmen: Domestic/International

Dec. 31, 1998; 214p; In English

Report No.(s): PB99-126898; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Contents include the following: Airway Notams; Airports, Facilities and Procedural Notams; General FDC Notams; Part 95 Revisions to Minimum en Route IFR Altitudes and Changeover Points; International Notices to Airmen; and Graphic Notices.

NTIS

National Airspace System; Air Navigation; Charts; Runways; Airports; Constrictions

19990036162 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
AVIATION SECURITY: FAA's Actions to Study Responsibilities and Funding for Airport Security and to Certify Screening Companies
Feb. 1999; 18p; In English
Report No.(s): AD-A360753; GAO/RCED-99-53; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

After the explosion of Pan Am Flight 103 in 1988, the Congress focused its attention on increasing aviation security, which culminated in the passage of the Aviation Security Improvement Act of 1990. Congressional interest was renewed in 1996 by the still unexplained crash of TWA Flight 800, which resulted in additional efforts by the federal government to increase aviation security. These efforts included the establishment of the White House Commission on Aviation Safety and Security in August 1996. The Commission's report, issued in February 1997, 1 made a number of recommendations to improve aviation security. In addition, two laws were enacted-the Federal Aviation Reauthorization Act of 1996 and the Omnibus Consolidated Appropriations Act of 19972 -which, among other things, authorized and provided funding for the security recommendations contained in the Commission's report.

DTIC
Aircraft Safety; Crashes; Flight Safety

19990036170 Quadrant Engineering, Inc., Amherst, MA USA
Evaluation of Technologies for the Design of a Prototype In-Flight Remote Aircraft Icing Potential Detection System ***Final Report***
Mead, James B.; Pazmany, Andrew; Goodberlet, Mark; Dec. 1998; 83p; In English
Contract(s)/Grant(s): DACA39-97-M-1476
Report No.(s): AD-A360772; DOT/FAA/AR-98/72; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document presents the results of an investigation of remote sensing technologies applicable to the problem of aircraft icing potential detection. The long-term goal is to develop an aircraft mounted sensor capable of detecting dangerous levels of supercooled liquid water tens of kilometers ahead of the aircraft. Clouds with supercooled liquid water exhibit a potential for icing that is a function of water content, and to some degree, the range of droplet diameters 14 CFR Part 25 Appendix C. Appendix C conditions are dangerous to aircraft without ice protection; however, they are not dangerous to most aircraft with ice protection. Instruments capable of mapping cloud liquid water content and mean particle size were investigated. Furthermore, instruments capable of probing air temperature were also investigated, in as much as they may provide a means of detecting regions of warmer air where drops are not supercooled.

DTIC
Ice Formation; Evaluation; Technology Assessment; Design Analysis; Prototypes; Pilotless Aircraft; Aircraft Icing; Clouds (Meteorology); Remote Sensors

19990036177 Naval Research Lab., Marine Meteorology Div., Monterey, CA USA
Meteorological Decision Aid Development and Validation for Naval Aviation
Neith, Mike; Brand, Sam; Jan. 1998; 4p; In English
Report No.(s): AD-A360811; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Support of Naval aviation, with a primary emphasis on flight safety and efficiency, has always been a priority of the environmental community within the Navy (Brand and Dreksler, 1995). The Naval Research Laboratory (NRL) Marine Meteorology Division has been involved in the development of several meteorological decision aids (MD As) to enhance this support. Aviation impact variables (AWs), such as cloud ceiling, visibility, flight conditions (IFR - Instrument Flight Rules, MVFR - Marginal Visual Flight Rules, VFR - Visual Flight Rules), and aircraft icing have been the focus of the decision aid development efforts thus far. These decision aids are designed to provide both environmental forecasters and aviators with state-of-the-art graphical displays of AIVs. The primary users of these decision aids will be the Naval Meteorology and Oceanography (METOC) Facilities and Detachments providing aviation weather forecast support ashore and the METOC component onboard major combatant ships that provide this support afloat. The Joint METOC Viewer (JMV), a viewer application developed by the Space and Naval Warfare Systems Command (SPAWAR) along with the Fleet Numerical Meteorology and Oceanography Center (FNMOC), has been the target application for transition of the decision aids (Ravid et al., 1997). JMV has been designed to provide users with a "quick-look" of the environment to evaluate its impact on mission planning and execution.

DTIC
Meteorology; Decision Support Systems; Meteorological Parameters; Proving; Instrument Flight Rules

19990036192 Colorado Univ., Aerospace Engineering Sciences, Boulder, CO USA

History and Economics of, and Prospects for, Commercial Supersonic Transport

Seebass, Richard, Colorado Univ., USA; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 1-1 - 1-6; In English; See also 19990036191; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Commercial transport at supersonic speeds has been a reality since 1976. Indeed, it has been a great technical success. The Concorde fleet has flown approximately 350,000 hours, most of them at supersonic speeds, and it has done so with high reliability. The twelve Concordes operating today have accumulated more supersonic fight hours than all of the world's military aircraft. These Concordes will be in service for many years to come. Scheduled Concorde flights are principally London - New York, Paris - New York. Reports on the Concorde indicate that the dozen now in service are well, but not always fully, utilized. The Concorde has been a success for the two airlines that operate this small fleet. Does a second generation SST make sense? This paper reviews the past programs and provides the author's own conclusion regarding the prospects for commercial supersonic transport.
Author

Commercial Aircraft; Economics; Supersonic Aircraft; Supersonic Commercial Air Transport

19990036626 Department of Energy, Washington, DC USA

Airport testing an explosives detection portal

Rhykerd, C., Department of Energy, USA; Linker, K., Department of Energy, USA; Hannum, D., Department of Energy, USA; Bouchier, F., Department of Energy, USA; Parmeter, J., Department of Energy, USA; Dec. 31, 1998; 5p; In English; 39th, USA; Meeting sponsored in part by Institute of Nuclear Materials Management

Report No.(s): DE98-006163; SAND-98-1871C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

At the direction of the US Congress, following the Pan Am 103 and TWA 800 crashes, the Federal Aviation Administration funded development of non-invasive techniques to screen airline passengers for explosives. Such an explosives detection portal, developed at Sandia National Laboratories, was field tested at the Albuquerque International airport in September 1997. During the 2-week field trial, 2,400 passengers were screened and 500 surveyed. Throughput, reliability, maintenance and sensitivity were studied. Follow-up testing at Sandia and at Idaho National Engineering and Environmental Laboratory was conducted. A passenger stands in the portal for five seconds while overhead fans blow air over his body. Any explosive vapors or dislodged particles are collected in vents at the feet. Explosives are removed from the air in a preconcentrator and subsequently directed into an ion mobility spectrometer for detection. Throughput measured 300 passengers per hour. The non-invasive portal can detect subfingerprint levels of explosives residue on clothing. A survey of 500 passengers showed a 97% approval rating, with 99% stating that such portals, if effective, should be installed in airports to improve security. Results of the airport test, as well as operational issues, are discussed.
NTIS

Airline Operations; Airports; Explosives Detection; Chemical Explosions; Airport Security; Explosive Devices

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19990035927 NASA Langley Research Center, Hampton, VA USA

A Simulation Study of Instrument Meteorological Condition Approaches to Dual Parallel Runways Spaced 3400 and 2500 Feet Apart Using Flight-Deck-Centered Technology

Waller, Marvin C., NASA Langley Research Center, USA; Scanlon, Charles H., NASA Langley Research Center, USA; March 1999; 104p; In English

Contract(s)/Grant(s): RTOP 538-04-11-17

Report No.(s): NASA/TM-1999-208743; NAS 1.15:208743; L-17785; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A number of our nations airports depend on closely spaced parallel runway operations to handle their normal traffic throughput when weather conditions are favorable. For safety these operations are curtailed in Instrument Meteorological Conditions (IMC) when the ceiling or visibility deteriorates and operations in many cases are limited to the equivalent of a single runway. Where parallel runway spacing is less than 2500 feet, capacity loss in IMC is on the order of 50 percent for these runways. Clearly, these capacity losses result in landing delays, inconveniences to the public, increased operational cost to the airlines, and general interruption of commerce. This document presents a description and the results of a fixed-base simulation study to evaluate an

initial concept that includes a set of procedures for conducting safe flight in closely spaced parallel runway operations in IMC. Consideration of flight-deck information technology and displays to support the procedures is also included in the discussions. The procedures and supporting technology rely heavily on airborne capabilities operating in conjunction with the air traffic control system.
Author
Meteorological Parameters; Simulation; Runways; Instrument Approach; Information Systems; Display Devices

19990036150 Oklahoma Univ., Dept. of Psychology, Norman, OK USA
Situation Awareness As a Predictor of Performance in En Route Air Traffic Controllers
Durso, Francis T.; Hackworth, Carla A.; Truitt, Todd R.; Crutchfield, Jerry; Nikolic, Danko; Jan. 1999; 15p; In English
Contract(s)/Grant(s): DTFA-02-D-93088
Report No.(s): AD-A360807; DOT/FAA/AM-99/3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this study, air traffic control instructors controlled simulated traffic while three techniques for determining situation awareness (SA) were implemented. SA was assessed using a self-report measure (SART); a query method that removed information on the plan-view display (SAGAT); a query technique that did not have a memory component (SPAM); and the detection of errors integrated into the scenarios (implicit performance). We used these measures of SA together with a measure of workload, NASA TDC, to predict two different performance measures. One performance measure was an over-the-shoulder, subjective assessment by a subject matter expert (SME). The other performance measure was a count of the number of control actions remaining to be performed at the end of the scenario. The SME evaluation was predicted by workload and the controller's appreciation of both the present and the future. The remaining-actions count (RAC) was predicted by the controller's appreciation of the future. In fact, an appreciation of the present led to poorer RAC scores: The better the participant was at answering questions about the present or the better he or she understood the present situation, the larger the number of actions remained to be performed. The results have implications for the relationships among workload, situation awareness, and performance, and suggest limitations on several of the measures currently proposed as SA techniques. The results confirm that future versus present is an important conceptual difference in air traffic control. More importantly, the results suggest that a controller who remains overly focused on the present may do so at the expense of the future.
DTIC
Air Traffic Controllers (Personnel); Air Traffic Control; Errors

19990036767 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
Air Traffic Control: Observations on FAA's Air Traffic Control Modernization Program
Mar. 25, 1999; 14p; In English; Testimony Before the Subcommittee on Aviation, Committee on Commerce, Science and Transporation, U.S. Senate.
Report No.(s): AD-A361560; GAO/T-RCED/AIMD-99-137; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1981, FAA began a multibillion-dollar modernization effort to improve the safety, capacity, and efficiency of this system to meet the increasing demand for air traffic services and to replace aging equipment. The agency's most recent estimate is that it will spend approximately $41 billion on the modernization effort through 2004. FAA has had some success in deploying new modernization systems over the past two decades. However, the agency has not delivered most of its major systems within cost, schedule, and performance goals due largely to its failure to implement established guidelines for acquiring new systems. Implementing disciplined acquisition management practices is key to allowing the agency to consistently deliver new systems within established goals. In light of past problems and continuing concerns about key projects funded under this program, you asked us to provide current information on the status of the modernization program based on prior reports and testimonies as well as ongoing work. Our statement will focus on (1) the causes of the problems that have plagued FAA'S modernization program for nearly two decades and (2) recent agency efforts to overcome these problems. We will also discuss our concerns about the readiness of FAA and others to meet Year 2000 requirements.
DTIC
Air Traffic Control; Deployment; Costs; Failure

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19990032449 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine France
System Identification for Integrated Aircraft Development and Flight Testing ***L'Identification des Systemes Pour le Developpement Integre des Aeronefs et des Essais en Vol***
System Identification for Integrated Aircraft Development and Flight Testing; March 1999; 412p; In English, 5-7 May 1998, Madrid, Spain; See also 19990032450 through 19990032478; Original contains color illustrations
Report No.(s): RTO-MP-11; AC/323(SCI)TP/7; ISBN 92-837-0006-6; Copyright Waived; Avail: CASI; A18, Hardcopy; A04, Microfiche

The NATO RTO symposium focused on the use of system identification as a "technology integrator". The symposium was organized in seven sessions covering an overview of recent aircraft programs, identification methodologies, flight test techniques, fixed-wing applications, rotary-wing applications, special vehicle applications (including UAVS) and a session comprising short papers covering "up-to-the-minute" flight test results. A final session presented prepared remarks from experts and concluded with an open discussion format to consider the key lessons learned in the application of system identification, and areas of needed future work.
Author
System Identification; Aircraft Design; Conferences; Flight Tests; Systems Engineering; Aerodynamics; Parameter Identification

19990032450 Boeing Co., Long Beach, CA USA
An Aircraft Manufacturer's View of Parameter Identification
Hodgkinson, John, Boeing Co., USA; Boland, Joseph R., Boeing Co., USA; Brandt, Meredith Q., Boeing Co., USA; Lavretsky, Eugene, Boeing Co., USA; Rossitto, Kenneth F., Boeing Co., USA; Stephens, A. Thomas, Boeing Co., USA; Stevenson, Scott W., Boeing Co., USA; Thompson, Thomas L., Boeing Co., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 1-1 - 1-24; In English; See also 19990032449; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Boeing adopts an eclectic approach to parameter identification methods. Time-domain methods for stability and control parameter estimation are used alongside frequency-domain methods which are chiefly used for determining lumped flying qualities parameters. Example applications described include use of identification to develop training simulators for transport aircraft, determining parameters and sensor corrections for fighter/attack aircraft, reconstructing an event for which partial data were available, determining the flying qualities changes due to helicopter modifications, and validating the dynamics of an in-flight simulator.
Author
Parameter Identification; Boeing Aircraft; Aircraft Design; Aircraft Stability; Aircraft Control; Flight Characteristics; Systems Engineering; Time Domain Analysis; Frequency Domain Analysis

19990032451 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany
The Role of System Identification for Flight Vehicle Applications: Revisited
Hamel, P. G., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Jategaonkar, R. V., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 2-1 - 2-12; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

During the last few decades system identification methodology has been extensively used for flight vehicle modeling. This paper provides an overview of the basic methodology, highlighting the classical approaches and indicating a few current trends. Successful application of advanced aircraft parameter estimation methods has been demonstrated on a few challenging examples such as determination of aerodynamic effects of secondary importance, identification of highly augmented unstable or flexible aircraft, and high bandwidth rotorcraft modeling. The selected examples demonstrate that the system identification methods have reached a maturity level that makes them a powerful and indispensable tool to support not only research but also the industry activities in various key areas such as model validation, handling qualities evaluation, control law design, and flight vehicle design. Thus, it contributes significantly to risk and cost reduction in the optimal deployment of existing aircraft and in the development of new generation flight vehicles.
Author
System Identification; Aerodynamics; Control Systems Design; Systems Engineering; Control Theory

19990032454 Kohlman Systems Research, Inc., Lawrence, KS USA

Developing Aerial Refueling Simulation Models from Flight Test Data Using Alternative PID Methods

Ryan, George Wesley, III, Kohlman Systems Research, Inc., USA; Platz, Stewart J., Kohlman Systems Research, Inc., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 5-1 - 5-10; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

To improve existing aerial refueling training devices, a flight test program was completed for several tanker/receiver pairs for the USA Air Force Air Mobility Command, by Kohlman Systems Research (KSR) and SIMTEC, Inc. These flight tests were designed to record accurate quantitative measurements of the aerodynamic changes and random turbulence acting on both the tanker and receiver during refueling, including accurate real-time relative position measurements of the aircraft. Because the aerial refueling environment is a quasi-steady state environment, flight test data reduction presented some unique problems. The lack of strong forcing function relationships in the data prohibited traditional parameter identification algorithms from working efficiently. Two separate alternative PID methods were developed during the production of an aerial refueling simulation of a C-141B receiver and a KC-135R tanker. The first was designed to identify the large aerodynamic changes associated with refueling. The second was designed to identify the random turbulence associated with the tanker flow field. This paper presents the results of the two methods. The first method is based on trimming the six equations of motion to match the simulation and flight test data. Aerial refueling coefficient deltas and a down-wash term identified from the data as a function of relative position were used to account for the large aerodynamic influences present. The second parameter estimation method was used to identify coefficients from recorded acceleration data. These coefficients were used in a random turbulence model to reproduce the power spectrum of the random turbulence associated with the aerial refueling environment. The end result is a simulation capable of reproducing the response of both aircraft during aerial refueling within tolerances similar to those used for single aircraft training device acceptance.

Author

Air to Air Refueling; Parameter Identification; Flight Simulation; Flight Tests; Motion Simulation; Real Time Operation

19990032455 NASA Langley Research Center, Hampton, VA USA

Advances in Experiment Design for High Performance Aircraft

Morelli, Eugene A., NASA Langley Research Center, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 8-1 - 8-17; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A general overview and summary of recent advances in experiment design for high performance aircraft is presented, along with results from flight tests. General theoretical background is included, with some discussion of various approaches to maneuver design. Flight test examples from the F-18 High Alpha Research Vehicle (HARV) are used to illustrate applications of the theory. Input forms are compared using Cramer-Rao bounds for the standard errors of estimated model parameters. Directions for future research in experiment design for high performance aircraft are identified.

Author

Aircraft Design; Aircraft Maneuvers; Parameter Identification; Control Systems Design; Systems Engineering

19990032456 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Preston, UK

Validation of FCS Structural Coupling Stability Characteristics Through In-Flight Excitation

Caldwell, Brian, British Aerospace Public Ltd. Co., UK; Felton, Richard, British Aerospace Public Ltd. Co., UK; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 9-1 - 9-10; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Paper will outline the background to the Structural Coupling 'problem', and the motivation for the development of the in-flight excitation system, analysis methodologies and tools for the Eurofighter project. The influence of the flight clearance requirements on the choice of a frequency domain approach to system identification and hence the system design will be noted. In this application, accuracy and reliability of the structural response phase measurement is of prime importance, and it has been necessary to understand every detail of the system time delays and dynamics interposed between the recorded input and output signals and the corresponding actual parameters, such that these effects can be modelled, and a true representation of in-flight flexible aircraft dynamics obtained. The process of building the required models is described, illustrated with example results from ground and flight tests. The paper will recommend further development and integrated design of the excitation and analysis methods to ensure full value is obtained from the costly flight test campaign.

Author

System Identification; Systems Engineering; Flight Characteristics; Flight Control; Aerodynamic Characteristics; Excitation; Structural Stability; Frequency Domain Analysis

19990032457 NASA Ames Research Center, Moffett Field, CA USA

Flight-Time Identification of a UH-60A Helicopter and Slung Load

Cicolani, Luigi S., NASA Ames Research Center, USA; McCoy, Allen H., Naval Postgraduate School, USA; Tischler, Mark B., Army Aviation and Missile Command, USA; Tucker, George E., NASA Ames Research Center, USA; Gatenio, Pinhas, Israel Flight Test Center, Israel; Marmar, Dani, Israel Flight Test Center, Israel; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 10-1 - 10-18; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes a flight test demonstration of a system for identification of the stability and handling qualities parameters of a helicopter-slung load configuration simultaneously with flight testing, and the results obtained. Tests were conducted with a UH-60A Black Hawk at speeds from hover to 80 kts. The principal test load was an instrumented 8 x 6 x 6 ft cargo container. The identification used frequency domain analysis in the frequency range to 2 Hz, and focussed on the longitudinal and lateral control axes since these are the axes most affected by the load pendulum modes in the frequency range of interest for handling qualities. Results were computed for stability margins, handling qualities parameters and load pendulum stability. The computations took an average of 4 minutes before clearing the aircraft to the next test point. Important reductions in handling qualities were computed in some cases, depending on control axis and load-sling combinations. A database, including load dynamics measurements, was accumulated for subsequent simulation development and validation.

Author

System Identification; Flight Tests; Longitudinal Control; Lateral Control; Loads (Forces); UH-60A Helicopter; Helicopter Control; Frequency Domain Analysis

19990032458 Science Applications International Corp., California, MD USA

Aircraft System Identification Using Integrated Software Tools

Linse, Dennis J., Science Applications International Corp., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 11-1 - 11-12; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

System identification is a complicated, multi-step process requiring considerable expertise to perform. In a traditional flight test program, the elapsed time from flying the aircraft and gathering data until the simulation is updated can be months or even years. The primary reasons behind the long times between flight test and simulation update are the labor-intensive processes of data processing and system identification. Too much time is spent manipulating data and models to the format needed by the disparate programs. The Integrated Data Evaluation and Analysis System (IDEAS) gathers existing software into a distributed client/server architecture that integrates all of the tools required to process flight test data. Using consistent data handling routines and a networked communication scheme, IDEAS can distribute tasks among heterogeneous processors while maintaining an integrated working environment. Tools are available for data preprocessing, filtering, consistency checking, aircraft simulation, equation error, and output error identification as well as communication paths to other existing programs such as frequency domain identification routines. An innovative modeling technique provides uniform access to complex, nonlinear model representations. A single, intuitive description of the identification model is processed by each of the different system identification methods with no recoding or rehosting required. As a demonstration of the capabilities of the integrated system, an analysis of flight test data from a twin turbofan military aircraft is conducted. The aerodynamic and engine models of the current operational flight trainer (OFT) are hosted under the IDEAS framework. Using both equation error and output error techniques, the simulation models are updated using the gathered flight data and validated against independent data. Where possible, nonlinear increments are added to augment the aerodynamics and engines to best match the available data. The updated simulation shows significant improvement in fidelity of the OFT across the flight envelope.

Author

System Identification; Computer Programs; Data Processing; Flight Tests; Flight Training; Data Simulation; Flight Characteristics; Parameter Identification

19990032459 Alenia, Flight Mechanics Group, Turin, Italy

Recent Experiences on Aerodynamic Parameter Identification for EUROFIGHTER at Alenia, British Aerospace, CASA, and Daimler-Benz Aerospace

Bava, Renzo, Alenia, Italy; Hoare, Graham T., British Aerospace Public Ltd. Co., UK; Garcia–Mesuro, Gabriel, Construcciones Aeronauticas S.A., Spain; Oelker, Hans–Christoph, Daimler-Benz Aerospace A.G., Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 12-1 - 12-11; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

EUROFIGHTER, a very agile configuration, which incorporates a high level of inhernet longitudinal instability, will be the new fighter aircraft for the airforces of Italy, UK, Spain, and Germany in the next century. It is being developed jointly by industrial partners of these four nations (Alenia, British Aerospace, Construcciones Aeronauticas S.A., and Daimler-Benz Aerospace). For flight test evaluation of the aerodynamic properties of this aircraft, four different partners confidence has to be established in different methods as well as in comparison between results of different development aircraft. The present paper gives an overview of company specific aerodynamic parameter identification methods. All methods are based on well known theories. Each method, though, incorporates some specific tailoring in order to cope with the characteristics of the basically unstable airframe. Results are given for four principal examples. At first a problem of the aircraft's weathercock stability is discussed. Discrepancies could be confirmed with all methods on different aircraft. The procedure of correcting the dataset is described and illustrated. The second example deals with the twin-seater. Certain increments representing the twin-seater could not be verified in flight test, it is shown how and why they are omitted. Presentation of time history matching illustrates the capabilities of all methods to deal with large perturbation manoeuvres. Finally identifying and reducing tolerances of the dataset leads to an improved flight clearance.
Author

Parameter Identification; Aircraft Design; Flight Tests; Fighter Aircraft; Aerodynamic Characteristics

19990032460 Boeing Co., Seattle, WA USA

A Process for Model Identification and Validation of Dynamical Equations for a Flexible Transport Aircraft

Najmabadi, Kioumars, Boeing Co., USA; Fritchman, Bruce, Boeing Co., USA; Tran, Chuong, Boeing Co., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 13-1 - 13-13; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper introduces a process for identification and validation of a single-input/multi-output model for a flexible aircraft based on in-flight control-surface frequency sweeps. This model is used to develop a compensator for active control of aircraft structural modes. The output of the system contains parameters used in the controller design cost function and those used as the feedback signals modified to include appropriate system time delays. The identification method parameterizes the system as a partial fraction expansion and solves a weighted, non-linear least square problem to determine the numerator and denominator coefficients. The initial values of the denominator coefficients are determined based on the higher order aeroelastic model. Once the initial values for the denominator coefficients are known, the initial values for the numerator terms are obtained by the linear least square technique. Two approaches are employed to prove the fidelity of the model for control law design. The first method uses the output signals of the model to provide a closed-loop description of the system for which an in-flight response characteristics exists. Comparison of the in-flight response characteristics with those of the model provides the confidence for the fidelity of the identified model. The second approach utilizes a newly developed compensator and compares the frequency response characteristics of the closed-loop system based on the in-flight sweep data and those based on the model. The closeness between the two frequency responses is treated as a measure of the fidelity of the model. An example of this process for identification and validation of a model for the lateral motion of a commercial transport aircraft is presented.
Author

Parameter Identification; Aircraft Design; Transport Aircraft; Aircraft Control; Active Control; Aircraft Models; Control Theory; Time Domain Analysis

19990032462 National Aerospace Lab., Amsterdam, Netherlands

In-Flight Model Identification Research Aimed at Developing a Flight SImulator Model

Breeman, J. H., National Aerospace Lab., Netherlands; Kannemans, H., National Aerospace Lab., Netherlands; Laban, M., National Aerospace Lab., Netherlands; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 15-1 - 15-12; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

In the last decade NLR and Delft University of Technology have conducted an cooperative research program using the Swearingen Metro II laboratory aircraft. Topics studied in this program are a/o instrumentation techniques, flight test techniques and the modeling of aerodynamics, engine thrust, and flight controls. As one of the topics it was decided to investigate the feasibility of in-flight on-line aerodynamic model identification. This paper summarizes the main results of the on-line identification project and then goes on to describe the following off-line analysis, which should lead to a complete flight simulator model for the Metro.
Author

Parameter Identification; Mathematical Models; Flight Tests; Aircraft Models; Flight Simulators; Flight Control; Aerodynamics; In-Flight Monitoring

19990032464 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany

Identification of Aircraft Stall Behavior From Flight Test Data

Fischenberg, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Jategaokar, R. V., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 17-1 - 17-8; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

An unsteady 5-DoF aerodynamic model for flow separation and stall is presented. The model formulates lift, drag, and the moments in pitch, roll, and yaw as a function of an internal state, namely the position of the flow separation point along the wing chord. In a quasi-steady case, this position is described as a function of the angle of attack and its rate of change, whereas in a transient case it is described in a state-space form using a first order differential equation. Using airfoil wind tunnel data, the plausibility of the model structure is discussed. In a second step, the parameters of the quasi steady and the transient model are identified for two different aircraft using stall flight test data. Validation plots demonstrate the model accuracy and it can be seen clearly that there are considerable unsteady effects at high angles of attack where flow separation occurs, which cannot be described properly using flight mechanic models for attached flow.

Author

Parameter Identification; Aerodynamic Stalling; Boundary Layer Separation; Aircraft Models; Separated Flow; Unsteady Aerodynamics

19990032466 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Flight Mechanics, Brunswick, Germany

Aerodynamic Model Extension and Validation of a Thrust Vectored Delta-Canard Configuration

Friehmelt, Holger, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 19-1 - 19-10; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Due to their advantages in aerodynamic characteristics, delta-canard configurations have experienced growing interest and have been realized in various recent aircraft designs. In addition, thrust vectoring has emerged as an efficient means of providing control power throughout the entire flight envelope. Aerodynamic modeling and identification of parameters for this kind of configurations have usually been restricted to the constant and linear terms in a Taylor series approximation of the force and moment coefficients. These modeling approaches are straight-forward and easy to handle in parameter identification processes but sometimes lack physical understanding of the flow phenomena encountered on delta-canard configuration with thrust vectoring system, although sometimes only of secondary importance, have been omitted completely so far. The present work postulates new extended models which include nonlinear and higher order terms in order to better model thrust vector characteristics. by looking at the flow phenomena involved, model formulations are introduced which can be explained and justified by the physical understanding.

Author

Flight Control; Parameter Identification; Thrust Vector Control; Canard Configurations; Mathematical Models; Aerodynamic Characteristics

19990032467 York Univ., Dept. of Electronics, UK

Time Domain Identification of Helicopters: A New Perspective

Clarke, T., York Univ., UK; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 21-1 - 21-9; In English; See also 19990032449

Contract(s)/Grant(s): EPSRC-GR/H80989; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The time-domain, observer-Kalman filter/eigensystem realization algorithm is successfully applied to the problem of generating a minimal state space model realization from a non-linear Lynx helicopter model. A linear realization is generated which gives a better representation of the non-linear model than that obtained using small perturbation linearization methods. The approach can be used to extract an unstable model from the flight data of a closed-loop stabilised system, even when the feedback dynamics are not precisely known.

Author

Feedback Control; Helicopters; System Identification; Mathematical Models; Algorithms; Time Domain Analysis

19990032468 Centre d'Etudes et de Recherches, Flight Systems and Dynamics Dept., Toulouse, France

Identification of the Flight Mechanics Model of a Low-Speed Helicopter ***Identification du Modele de Mecanique du Vol d'un Helicoptere aux Basses Vitesses***

Gimonet, B., Centre d'Etudes et de Recherches, France; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 22-1 - 22-8; In French; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Dauphin 6075, in service at the Flight Trials Center (CFV), supports many flight trials under contract to French Official Services (SPAe). This experimental device has been used in DLR/ONERA collaboration on the Smart Helicopter concept for modeling of the low-speed helicopter. This text describes the work undertaken in order to identify a linear model. Preliminary work on selection of valid trials and on the choice of model structure is carried out. The need to introduce the first beating harmonic into the model and, for later work, non-linear terms, is discussed. A traditional technique for minimizing output error, with selection of significant parameters, working within the frequency domain, provides an assessment of the principal stability and command derivatives. A comparison of results obtained with models including 6 or 9 degrees of freedom is presented.

Transl. by Schreiber

Parameter Identification; Stability Derivatives; Mathematical Models; Helicopter Design

19990032469 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany

Nonlinear Rotorcraft Modeling and Identification

Rohlfs, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; vonGruenhagen, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kaletka, J., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 23-1 - 23-13; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Since regulations for the evaluation of helicopter flight simulators were published in the Advisory Circular 120-63 (AC 120-63) of the Federal Aviation Administration, the need of increasing the simulation fidelity of the helicopter mathematical models becomes more and more relevant to meet the new more restricted requirements. In the Institute of Flight Mechanics mainly two approaches are used to develop helicopter mathematical models. First, linear derivative models are identified from flight test data. The second approach uses detailed vehicle characteristics for the development of a nonlinear helicopter simulation program. The paper describes the two helicopter mathematical modeling approaches and discusses their advantages and disadvantages. Finally, a third approach is introduced, which combines the advantages of both, the linear identified models and the nonlinear generically derived models. Results from all three modeling approaches are presented in both, the time and frequency domain. They are discussed with respect to some selected requirements given in the new FAA advisory circular on helicopter simulator qualification AC 120-63. Finally, conclusions are made and an outlook of future activities is given.

Author

Mathematical Models; Helicopters; Simulation; Parameter Identification

19990032470 Institute for Aerospace Research, Flight Research Lab., Ottawa, Ontario Canada

The Inclusion of Higher-Order Rotor Dynamics to Improve the Dynamic Model of a Single Rotor Helicopter in Hover

Hui, Kenneth, Institute for Aerospace Research, Canada; Srinivasan, Ramesh, Institute for Aerospace Research, Canada; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 25-1 - 25-13; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes the development of a higher-order, rotor dynamic mathematical model of a single-rotor helicopter from flight test data, and illustrates the improvements in model fidelity realized by the inclusion of higher-order terms in the model. This model development is based on flight data gathered from ”3211” and ”frequency sweep” manoeuvres with the NRC Bell 412HP helicopter in hover. The data suite included the standard fuselage response parameters. This flight data was analysed using both the time domain (Maximum Likelihood Estimation or MLE) and frequency domain (CIFER) system identification techniques. The resulting models, from both the time and frequency domain techniques, with the various combinations of the higher-order rotor dynamic terms included, are compared to determine the improvements derived by each approach.

Author

Mathematical Models; Hovering; Helicopters; Dynamic Models; System Identification; Time Domain Analysis; Frequency Domain Analysis

19990032473 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany

Direct Update of a Global Simulation Model with Increments via System Identification

Rohlf, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 28-1 - 28-11; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes a method using system identification for a data base update where the aerodynamic coefficients derived from the original wind tunnel data base are supplemented by increments. The model update is performed applying a regression method to match the model calculated accelerations with the in-flight measured accelerations. The work is based on flight test data of the thrust-vectored research aircraft X-31A. Its simulation model is updated in the entire flight envelope using a representative selection from all flight maneuvers which became available in this project. More than 3000 seconds of flight test are evaluated in one identification run covering an angle of attach regime from about -5 deg up to 70 deg and Mach numbers from about 0.2 up to 1.25. A practice flight for the spectacular X-31A demonstration at the Paris Air Show '95 is used for model verification. Thrust is calculated from flight measured power lever position using an existing static engine table model. A rate limited first order dynamic engine model with additional time lag to account for after-burner ignition is implemented. Thrust amount and thrust vector effectiveness are estimated separately for after-burner on and off. Actual c.g.-location, A/C weight and inertia are taken into account based on existing weight and balance data with measured fuel quantity as input. The latter is corrected for fuel slosh impact depending on tank filling ratio and translational A/C Accelerations.

Author

System Identification; Aerodynamic Coefficients; Flight Simulation; Mathematical Models; Data Processing; X-31 Aircraft

19990032474 Royal Military Coll. of Science, DAPS, Shrivenham, UK

ARMOR UAV Identification Using an Adaptive Hybrid Genetic Algorithm

Bruce, Peter D., Royal Military Coll. of Science, UK; Kellett, Martin G., Royal Military Coll. of Science, UK; Azinheira, J. R., Instituto Superior Tecnico, Portugal; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 29-1 - 29-7; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper presents the use of an Adaptive Hybrid Genetic Algorithm for the Maximum Likelihood identification of aircraft dynamics. The technique is compared to the conventional Modified Newton-Rhapson method and to the simplex method for the identification of a linear model of the dynamics of the ARMOR UAV. A simple example is used to illustrate the method's advantages when identifying nonlinear systems. The method has advantages over the Modified Newton-Rhapson method in that initial parameter estimates do not have to be stated, rather, a bound on the parameters is given. It also does not suffer from numerical problems sometimes evident with gradient-based optimisation techniques and it can locate the global minimum when a multimodal cost function is present. It is also simple to incorporate initial parameter estimates if available.

Author

Genetic Algorithms; Maximum Likelihood Estimates; Aerodynamic Characteristics; Aircraft Stability; Aircraft Control; Parameter Identification; Aircraft Design

19990032477 Dassault Aviation, Direction Generale Technique, Saint-Cloud, France

Analysis of the Theoretical Modeling of the Cost of Army Aircraft by Flight Validation *Separation de Charge Sous Avion D'Armes de la Modelisation Theroique a la Validation en Vol*

Fleygnac, D., Dassault Aviation, France; Bariant, P., Dassault Aviation, France; Rapuc, M., Dassault Aviation, France; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 32-1 - 32-12; In French; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The multiple aviation capability of former forces, especially the capacity to carry out multiple mission and various responsibilities assure their commitment to missions: bombing, guided missiles, and releasable ordnance. The cost of complying with this period of exigency permits only a new generation of aircraft such as RAFALE, which provide a capacity for greatly extended missions and developments concerning future armaments.

Transl. by CASI

Mathematical Models; Aerodynamic Characteristics; Aircraft Design; Flight Characteristics; Systems Engineering

19990036133 Arizona Univ., Dept. of Aerospace and Mechanical Engineering, Tucson, AZ USA

Active Flow Control on Hurley's Free-Streamline Airfoil and Delta *Final Report, 1 Mar. - 31 Aug. 1998*

Wygnanski, Israel; Madenci, Erdogan; Saric, William; Reed, Helen; Feb. 12, 1999; 21p; In English

Contract(s)/Grant(s): F49620-98-1-0298

Report No.(s): AD-A360483; AFRL-SR-BL-TR-99-0055; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This was a joint effort by The University of Arizona (UA) and Arizona State University (ASU). The work was directed toward the application of active flow control to a free-streamline airfoil whose structural vibrations were integrated into the control strategy. The Phase I accomplishments reported here demonstrate that efficient tree-shear-layer control is possible and the low drag of the free-streamline airfoil is a reality.
DTIC
Delta Wings; Fluid Mechanics; Active Control; Flow Distribution; Airfoils

19990036171 Army Research Lab., Survivability/Lethality Analysis Directorate, White Sands Missile Range, NM USA
Anomalies Incurred by E3 Tests Made in the Near Field ***Final Report***
Arthur, Joy L., Army Research Lab., USA; Brown, Glenn, REAP Associates, Inc., USA; Feb. 1999; 50p; In English
Report No.(s): AD-A360773; ARL-TR-1733; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Under realistic conditions, helicopters are exposed to electromagnetic (EM) radiation from friendly and hostile sources. The radiating source is sufficiently far away that the helicopter is in the far field of the source antenna and plane wave conditions apply. to determine how the systems and subsystems on board the helicopter are affected by electromagnetic environment effects (E3), the tests are normally performed under controlled laboratory or controlled field conditions. The tests are performed with the test object in the near field rather than in the far field zone of the source antenna. The helicopter under test is ”spot” illuminated instead of being totally illuminated by plane waves. This report provides an understanding of the magnitude of the uncertainties incurred when E3 tests are performed in the near field rather than plane wave environment.
DTIC
Electromagnetic Fields; Helicopters; Far Fields; Environment Effects; Electromagnetic Radiation; Electromagnetic Properties

19990036183 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Analysis of Widespread Fatigue Damage in Aerospace Structures ***Final Report, 15 Feb. - 30 Nov. 1998***
Grandt, A. F., Jr.; Farris, T. N.; Hillberry, B. H.; Feb. 1999; 158p; In English; Prepared in cooperation with the Scool of Mechanical Engineering, Purdue Univ. W. Lafayette, IN.
Contract(s)/Grant(s): F49620-98-1-0293
Report No.(s): AD-A360820; AFRL-SR-BL-TR-99-0076; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report summarizes research dealing with analyzing the effects of widespread fatigue damage on aircraft structural integrity. Results are described for determining how cracks nucleate by corrosion, fatigue, or fretting fatigue, and once formed, grow, coalesce and lead to final fracture. The research is conducted in the context of the aging aircraft issue, which focuses on determining procedures for ensuring the continued safety of aircraft that operate beyond their original design lifetimes.
DTIC
Fatigue (Materials); Aircraft Structures; Structural Failure; Cracks

19990036195 Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia
Complex Experimental Studies of SST, Part 1, Aerodynamics of Individual Elements
Kharitonov, A. M., Institute of Theoretical and Applied Mechanics, Russia; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 4-1 - 4-25; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The achievement of aerodynamic perfection of supersonic flying vehicles is determined to a large extent by the depth of understanding of aerodynamics of the main aircraft element and the optimum use of aerodynamic interference of individual elements: wing, fuselage (airframe), engine nacelle, and other superstructures. A successful solution of these problems requires the study of regularities of three-dimensional flow around the developed geometric configurations, which is characterized at supersonic speeds by the presence of shock waves and expansion fans, by their interaction with each other and with boundary layers. In most cases, these interactions of boundary layers, the size and position of separation regions are determined by the body geometries, flight conditions, and/or relative positions of the bodies in space. These problems form one of the basic experimental research directions of the Aerodynamics Laboratory of the Institute of Theoretical and Applied Mechanics SB RAS. Vast experimental information has been accumulated on the flow around both schematic configurations of promising flying vehicles and models of specific aircraft under development. All experiments were conducted in the supersonic wind tunnel T-313 of ITAM SB RAS equipped with specially developed devices, methodology, and software for the study of interference of various aircraft elements. The wind tunnel T-313 of our Institute is a blowdown tunnel with square test section (size 0.6 x 0.6 m) and Mach number range from 2 to 6. The region of Reynolds number modeling is shown here with regard for all constructive restrictions. A multiple statistical analysis for various Mach numbers allows one to characterize the nonuniformity of the field of velocities in the zone of model location for the last twenty-five years of the wind tunnel performance. The nonuniformity degree of the field of velocities in the

test section is maintained at a level not exceeding 0.5%. Multiple measurements of accuracy reference models as against the similar data obtained in various wind tunnels: VKF, ONERA, DLR, etc. are demonstrated. The present lecture is devoted to various aspects of HSCT aerodynamics which yield a notion of versatility and complexity of experiments and obtained results. Apart from their own significance, these results are of interest for verification of the computational fluid dynamics (CFD) models and methods.
Author
Aerodynamic Characteristics; Supersonic Speed; Supersonic Transports; Three Dimensional Flow; Aircraft Design; Aircraft Structures; Wind Tunnel Tests; Aerodynamics

19990036196 Daimler-Benz Aerospace A.G., Bremen, Germany
Required Technologies for Supersonic Transport Aircraft
Mertens, Josef, Daimler-Benz Aerospace A.G., Germany; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 5-1 - 5-16; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

After referring to the remarkable technology level which Concorde has achieved, the most challenging new requirements for a future Supersonic Civil Transport are presented. It is proposed how to estimate influences of technology improvements on aircraft flight performance. A survey on key technologies follows with special emphasis on aerodynamic technologies.
Author
Supersonic Commercial Air Transport; Concorde Aircraft; Aerodynamics; Supersonic Flight; Aircraft Design

19990036198 Daimler-Benz Aerospace A.G., Bremen, Germany
Multi Point Design Challenges for Supersonic Transports
Mertens, Josef, Daimler-Benz Aerospace A.G., Germany; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 8-1 - 8-12; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In the lecture "Required Technologies for Supersonic Transport Aircraft" one of the new challenges for a Super-sonic Commercial Transport (SCT) was multi point design for the four main design points: supersonic cruise, transonic cruise, transonic acceleration, and take-off and landing. Besides engine technology, aerodynamics are most challenged by these differing requirements. But aerodynamic solutions will only become viable when contributing to an optimum of the whole aircraft; this is to be found in cooperation with all disciplines. Here, we deal with the most important aerodynamic parameters at the different design points and consequences for aerodynamic design.
Author
Supersonic Transports; Aerodynamics; Aircraft Design; Supersonic Aircraft; Aerodynamic Characteristics; Aerodynamic Configurations

19990036201 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, German Aerospace Center, Goettingen, Germany
Geometry Tools for Multidisciplinary Optimization
Sobieczky, Helmut, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 11-1 - 11-7; In English; See also 19990036191; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Design tools for high speed design aerodynamics are developed using sets of mathematical functions to create curves and surfaces in 3D space, steady or moving for unsteady phenomena, adaptation, and optimization. Coupled with fast grid generation, input for CFD verification of preliminary design variations may be created. Aerodynamic applications for conventional (HSCT) and novel (OFW) supersonic transport aircraft are illustrated, with future prospects to use geometry generation of internal structures, control surfaces and engines for multidisciplinary optimization. The geometry generator is a preprocessor to provide knowledge-based input for CAD and CFD methods.
Author
Multidisciplinary Design Optimization; Computer Programs; Computer Aided Design; Supersonic Transports; Grid Generation (Mathematics); Aerodynamic Configurations; Supersonic Aircraft; Aircraft Design

19990036205 National Aerospace Lab., Tokyo, Japan
Overview of NAL's Program Including the Aerodynamic Design of the Scaled Supersonic Experimental Airplane
Yoshida, Kenji, National Aerospace Lab., Japan; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 15-1 - 15-16; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

NAL is promoting on un-manned scaled supersonic experimental airplane program consisting of an un-powered and a jet-powered airplanes. The main objective of the program is to establish an integrated design system with a CFD-based optimum

method aiming at higher lift-to-drag ratio characteristics through flight tests of both experimental airplanes. Presently NAL has just designed an aerodynamic configuration of the first experimental airplane. This airplane plays a role of confirming supersonic drag reduction concepts incorporated in the design. Some of them are well known as an arrow planform, a warped wing and an area-ruled body, and they are used to reduce pressure drag. Furthermore as an original and challenging concept, natural laminar flow (NLF) wing design was tried to reduce friction drag. A target pressure distribution similar to a step function was derived from physical consideration with a current practical transition prediction code. The design process consisted of two stages. At the first stage, supersonic lifting surface theory and slender body theory were used. At the second stage, CFD (Navier-Stokes) code originally developed by NAL was effectively applied. Especially for the NLF wing design, a new inverse design method with CFD analysis was developed. Based on those concepts and tools, an optimum aerodynamic configuration was designed and the designed pressure distribution was validated by wind tunnel tests. Finally flight test plan for the airplane and further studies for an optimum design of jet-powered airplane are summarized.
Author
Supersonic Aircraft; Aircraft Design; Aerodynamic Configurations; Research Aircraft; Supersonic Commercial Air Transport; Aerodynamics; Laminar Flow; Aircraft Structures; Computational Fluid Dynamics

19990036209 British Aerospace Public Ltd. Co., Aerodynamics Dept., Lancashire, UK
Aspects of Wing Design for Transonic and Supersonic Combat Aircraft
Probert, B., British Aerospace Public Ltd. Co., UK; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 19-1 - 19-19; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes some aspects of high speed design, mainly wing design, for combat aircraft. This is done by first reviewing the fundamental features and problems posed by high speed transonic and supersonic flow and the means of alleviating them. The resulting empirical / simple rules and methods allow an initial baseline configuration to he developed which is further optimized using the most appropriate design processes - involving the use of a number of CFD codes, which are described. Each process is then illustrated by briefly considering the design of four types of high speed aircraft each optimized for a different, but overlapping, flight envelope. The current need for processes to treat the design of novel configurations which have low observability is mentioned and finally current ways of working are reviewed and suggestions made for future developments in the areas of design processes, aerodynamic improvements/fixes and the potential of new physical phenomena.
Author
Wings; Aircraft Design; Fighter Aircraft; Supersonic Aircraft; Computational Fluid Dynamics; Euler Equations of Motion; Navier-Stokes Equation; Aerodynamic Configurations; Transonic Speed

19990036295 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
F-22 Aircraft Issues in Achieving Engineering and Manufacturing Development Goals
Mar. 1999; 32p; In English
Report No.(s): AD-A360907; GAO/NSIAD-99-55; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As required by the National Defense Authorization Act for Fiscal Year 1998 (P.L. 1O5-85), we reviewed the Air Force's F-22 engineering and manufacturing development (EMD) program. This report, an update to a report we issued last year presents our conclusions regarding whether the Air Force is likely to complete the EMD program without exceeding the cost limitation established by the act. The act also requires us to certify whether we had access to sufficient information to make Informed judgments on matters covered by this report.
DTIC
Fighter Aircraft; F-22 Aircraft; Defense Program

19990036425 Loughborough Univ. of Technology, Dept. of Aeronautical and Automotive Engineering and Transport Studies, UK
Review of Requirements and Procedures
Render, P. M., Loughborough Univ. of Technology, UK; Simpson, M. P., Loughborough Univ. of Technology, UK; July 1997; In English
Report No.(s): TT-9706; ISBN 0-904947-54-8; Copyright; Avail: Issuing Activity (Dept. of Aeronautical & Automotive Engineering and Transport Studies, Loughborough Univ., Loughborough, Leicestershire, LE11 3TU UK), Hardcopy, Microfiche

This report is part of a European Commission funded project, "European Research on Aircraft Ice Certification" (EURICE). It presents the work carried out in Work Package three (WP3) subtasks: review of the certification process and review of the opera-

tional requirements and procedures. The aim of this work were twofold: firstly to determine whether the current airworthiness certification and means of compliance for flying in icing conditions for turboprop and rotorcraft were adequate, and to identify any improvements required. The second aim was, to investigate whether the operational procedures are adequate and whether any improvements were required.
Derived from text
Procedures; Ice Formation; Certification; Aircraft Reliability

19990036742 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Fatigue Response of Repaired Thick Aluminum Panels With Bondline Flaws
Conley, David S.; Mar. 1999; 144p; In English
Report No.(s): AD-A361591; AFIT/GAE/ENY/99M-03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This research investigated the fatigue response of precracked 558 x 177.8 x 6.35 mm (22.0 x 7.0 x 0.25 in) 2024-T351 aluminum panels repaired with single-sided partially bonded, unidirectional, eighteen ply boron/epoxy reinforcements. Disbonds were introduced into the bondline of each repair during the adhesion process using teflon inserts. Five different disbond configurations, with varying disbond locations and sizes, were tested. Each repaired panel was subjected to constant amplitude cyclic fatigue loading with a maximum stress of 120MPa. Results from the different configurations were compared against one another and against repaired panels with no debonds to assess the effect of disbonds on repair life. Results from the experimentation showed that even in the case of very large disbonds (20% of total bond area), the bonded repairs significantly extended the lives of the cracked panels. Disbond configurations with disbonds located away from the crack in the aluminum panel, performed comparably to the repaired panel with no disbonds. Disbond configurations with disbonds covering the crack in the aluminum panel yielded slightly lower lives than those obtained from repaired panels with no disbonds. Cyclic fatigue loading caused no increase in size of the artificially induced disbonds. Cyclic disbond growth was observed in the immediate vicinity of the crack. Finite element analysis using the Three Layer Technique was performed to assess the ability of current modeling techniques in predicting the life of cracked thick aluminum panels repaired with composite patches. Results from the finite element analysis were shown to very closely match experimental data.
DTIC
Aluminum Alloys; Adhesion; Cyclic Loads; Boron-Epoxy Composites; Cracks; Fatigue (Materials)

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19990032472 NASA Ames Research Center, Moffett Field, CA USA
Solar Powered Stratospheric Research Aircraft: Flight Test and System Identification
Lisoski, Derek L., AeroVironment, Inc., USA; Tischler, Mark B., NASA Ames Research Center, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 27-1 - 27-10; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

On July 7th, 1997, the NASA Pathfinder solar-powered aircraft flew to a record altitude of 71,500 feet; establishing new world altitude records for electric powered and propeller-driven aircraft. The Pathfinder platform, developed by AeroVironment for NASA's Environmental Research Aircraft and Sensor Technology (ERAST) program, is an unmanned solar-powered flying wing which serves as the first of a series of technology demonstrators which are slated to include the 100,000 ft attitude Centurion and the multi-week duration Helios solar aircraft. During the 1997 flight test deployment at the Pacific Missile Range Facility, Kauai, Hawaii, Pathfinder flew a total of six times, establishing the viability of a solar powered aircraft for scientific and commercial payload missions. During this flight test series, extensive use was made of the CIFER(R) frequency response analysis code for initial simulation verification, in-flight real-time stability determination, and post-flight system identification to ensure flight safety. This paper presents an overview of Pathfinder and the flight test program, outlines some of the analysis techniques used, and summarizes their results.
Author
System Identification; Flight Tests; Research Aircraft; Solar Powered Aircraft; Flight Control; Systems Engineering

19990036203 Aerospatiale Aeronautique, Aerodynamics Dept., Toulouse, France

Propulsion System Design for the European Supersonic Civil Transport Aircraft

Prat, D., Aerospatiale Aeronautique, France; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 13-1; In English; See also 19990036191; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The three major European aircraft manufacturers have agreed on a common configuration for the future supersonic transport aircraft: the ESCT (European Supersonic Civil Transport aircraft). Daimler-Benz Aerospace, British Aerospace, and Aerospatiale are working in close cooperation to make this project a reality. The technical feasibility of the future supersonic aircraft (SCT) depends on critical items such as high temperature materials, noise reduction during take-off, low NO(x) emissions, wave drag reduction, weight reduction, artificial vision ... etc. In order to cope with these items, the European Supersonic Research Program (ESRP) has been established between the three above-mentioned aircraft manufacturers and their related national research establishments (NRE): DLR for Germany, DERA for Great Britain, and ONERA for France. Within the ESPP project, aircraft manufacturers not only could work with their related NREs but also with the NREs from the other countries to give a better flexibility to the project. The aim of ESRP is to provide and verify essential technologies for the development of an economically and environmentally viable SCT. Main fields covered within the ESRP are: Aerodynamics, Propulsion integration, Structure/materials, Systems, and Technology integration.

Derived from text

Propulsion System Configurations; Supersonic Aircraft; Systems Engineering; Aerodynamics; Transport Aircraft; Aircraft Design

19990036204 Aerospatiale Aeronautique, Aerodynamic Dept., Toulouse, France

Application of CFD Methods to Propulsion System Integration in the Future Supersonic Transport Aircraft

Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 14-1 - 14-10; In English; See also 19990036191; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The economic viability of a future supersonic transport aircraft requires ambitious aerodynamic performance. Owing to its large impact on aircraft performance, the aerodynamic design of the future supersonic transport aircraft propulsion system is of utmost importance to Aerospatiale. However, it represents a particularly long and difficult task. The use of new CFD methods proved to be very helpful and powerful in designing the whole propulsion system. Through this process, Aerospatiale has developed know-how on both the internal and the external parts of the propulsion system. Although the internal components of the propulsion system, i.e. the air intake, engine and nozzle have to be studied as a whole, the internal performance of a supersonic air intake is highly dependent on overall aircraft configuration. It therefore requires special care from the aircraft designer in the trade-off between internal performance (pressure recovery and operating characteristics) and external drag. CFD methods, by simulating operating characteristics, provide a tool for better understanding the phenomena involved in flow physics. These tools, associated with overall expertise on intake design, were used to define and test a supersonic air intake. The high level of information provided by modem CFD methods is a key point for both internal and external flow analysis. The code used by Aerospatiale was developed in cooperation with ONERA. It includes Euler and Navier-Stokes solvers with space marching and Parabolized Navier-Stokes capabilities for fully supersonic flows. These last two capabilities allow complex industrial geometries to be studied while drastically reducing computing time. Considering the ability of the code to represent accurate physical phenomena, its Euler, as well as PNS and full Navier-Stokes capabilities, were used in the whole propulsion system integration process. The external design of nacelles results from a careful analysis of the flow pattern on the wing's lower surface. A proposed geometry is obtained by minimizing the total drag while considering local flow conditions and the strong aerodynamic interactions of the nacelles. The various levels of modelling of the CFD code provide an appropriate cost-effective answer to each type of physical phenomenon found in the flow pattern around the nacelles. This capability is essential for defining the best trade-off in the aerodynamic design of the propulsion integration. Experimental data are presented confirming the overall design process.

Author

Supersonic Aircraft; Propulsion System Configurations; Supersonic Flow; Transport Aircraft; Navier-Stokes Equation; Computational Fluid Dynamics; Aircraft Engines; Engine Design; Systems Integration

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19990032452 Army Aviation and Missile Command, Aeroflightdynamics Directorate, Moffett Field, CA USA
System Identification Methods for Aircraft Flight Control Development and Validation
Tischler, Mark B., Army Aviation and Missile Command, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 3-1 - 3-18; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

System identification methods compose a mathematical model, or series of models, from measurements of inputs and outputs of dynamic systems. The extracted models allow the characterization of the response of the overall aircraft or component subsystem behavior, such as actuators and on-board signal processing algorithms. This paper discusses the use of frequency-domain system-identification methods for the development and integration of aircraft flight-control systems. The extraction and analysis of models of varying complexity from nonparametric frequency-responses to transfer-functions and high-order state-space representations is illustrated using the Comprehensive Identification from FrEquency Responses (CIFER(R)) system-identification facility. Results are presented for test data of numerous flight and simulation programs at the Ames Research Center including rotorcraft, fixed-wing aircraft, advanced short takeoff and vertical landing (ASTOVL), vertical/short takeoff and landing (V/STOL), tiltrotor aircraft, and rotor experiments in the wind tunnel. Excellent system characterization and dynamic response prediction is achieved for this wide class of systems. Examples illustrate the role of system identification technology in providing an integrated flow of dynamic response data around the entire life-cycle of aircraft development from initial specifications, through simulation and bench testing, and into flight-test optimization.
Author
System Identification; Flight Control; Dynamic Response; Aircraft Design; Control Systems Design; Systems Engineering; Parameter Identification; Systems Integration; Frequency Domain Analysis

19990032453 Aerospatiale, Toulouse, France
Identification Tools for Lateral Flight Mechanics of Airbus Aircraft ***Outils d'Identification de la Mecanique du Vol Laterale des Airbus***
Liot, D., Aerospatiale, France; Bucharies, A., Office National d'Etudes et de Recherches Aerospatiales, France; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 4-1 - 4-9; In French; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

For each plane developed, AEROSPATIALE is equipped with a flight mechanics model in order to: ensure the analysis of the aircraft's flight capabilities; assist in defining and validating flight command laws (automatic and manual); and help in training commerical aircraft company crews. This model must cover all of the aircraft's situations (normal, peripheral, failure situations, etc.) with the highest possible representativity. In practical terms it is gradually being constructed. Theoretical calculations in combination with experience gained thus far, as well as wind tunnel trials, have already allowed us to develop a provisional model which is quite satisfactory. However, the required precision can only be attained by resetting it based on the flight behavior analysis of trial aircraft. AEROSPATIALE, in collaboration with ONERA, has developed two identification tools, IDLAT_NL and COR_NL, which reset the provisional lateral aerodynamic models in linear and non-linear zones. The latter have been successfully operated during the latest Airbus programs.
Transl. by Schreiber
System Identification; Flight Characteristics; European Airbus; Lateral Control; Systems Engineering; Control Systems Design

19990032463 NASA Langley Research Center, Hampton, VA USA
Closed-Loop System Identification Experience for Flight Control Law and Flying Qualities Evaluation of a High Performance Fighter Aircraft
Murphy, Patrick C., NASA Langley Research Center, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 16-1 - 16-13; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper highlights some of the results and issues associated with estimating models to evaluate control law design methods and design criteria for advanced high performance aircraft. Experimental fighter aircraft such as the NASA High Alpha Research Vehicle (HARV) have the capability to maneuver at very high angles of attack where nonlinear aerodynamics often predominate. HARV is an experimental F/A-18, configured with thrust vectoring and conformal actuated nose strakes. Identifying closed-loop models for this type of aircraft can be made difficult by nonlinearities and high-order characteristics of the system. In this paper

only lateral-directional axes are considered since the lateral-directional control law was specifically designed to produce classical airplane responses normally expected with low-order, rigid-body systems. Evaluation of the control design methodology was made using low-order equivalent systems determined from flight and simulation. This allowed comparison of the closed-loop rigid-body dynamics achieved in flight with that designed in simulation. In flight, the On Board Excitation System was used to apply optimal inputs to lateral stick and pedals at five angles of attack: 5, 20, 30, 45, and 60 degrees. Data analysis and closed-loop model identification were done using frequency domain maximum likelihood. The structure of the identified models was a linear state-space model reflecting classical 4th-order airplane dynamics. Input time delays associated with the high-order controller and aircraft system were accounted for in data preprocessing. A comparison of flight estimated models with small perturbation linear design models highlighted nonlinearities in the system and indicated that the estimated closed-loop rigid-body dynamics were sensitive to input amplitudes at 20 and 30 degrees angle of attack.
Author
Parameter Identification; Aircraft Design; System Identification; Flight Tests; Feedback Control; Directional Control; Controllers; Flight Control; Research Vehicles; Thrust Vector Control

19990032476 Glasgow Univ., Dept. of Aerospace Engineering, UK
Identification of Gyroplane Stability and Control Characteristics
Houston, S., Glasgow Univ., UK; Thomson, D., Glasgow Univ., UK; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 31-1 - 31-11; In English; See also 19990032449
Contract(s)/Grant(s): CAA-7D/S/1125; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents an analysis of test data recorded during flight trials of a gyroplane. This class of rotary-wing aircraft has found limited application in areas other than sport or recreational flying. However, the accident rate is such that a study of the configuration's stability and control characteristics is timely, and in addition substantive data is required for a new airworthiness and design standard that is under development. The paper discusses the special nature of the application of system identification tools to the gyroplane problem, particularly in the context of lack of a priori knowledge of the type's dynamic characteristics, design of installation and experiments, and data analysis.
Author
System Identification; Helicopters; Helicopter Control; Gyroscopic Stability; Control Systems Design; Parameter Identification; Frequency Domain Analysis

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19990032461 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany
Data Base Development for Level D Simulators: Lessons Learned
Moennich, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Jategaonkar, R. V., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 14-1 - 14-8; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In the recent past aerodynamic data bases meeting the stringent accuracy requirements of Level D flight simulators have been generated at the DLR Institute of Flight Mechanics for two propeller aircraft, namely the C-160 military transport aircraft and the Dornier 328 commercial passenger transport aircraft. In the case of Dornier 328 having reversible flight controls, in addition to the rigid body aerodynamics, it was required to generate the hinge moment data base. Furthermore, it was also necessary to demonstrate the end-to-end match resulting from an integrated model with pilot's force inputs (i.e. 6-DOF equations of aircraft motion incorporating the identified aerodynamic data base coupled with the dynamic models of the flight control systems driven through pilot applied forces and incorporating the identified hinge moments data base). In contrast to the usual approach of demonstrating the adequacy based on a model driven through control surface inputs adopted in the case of C-160, the force driven models of the Dornier 328 turned out to be significantly more complex. This paper highlights the approach adopted for generating the data bases, the difficulties encountered in the data generation, and the lessons learned therefrom.
Author
Control Surfaces; Flight Control; C-160 Aircraft; Flight Simulators; Aircraft Models; Aerodynamics; Aircraft Design

19990035991 National Aerospace Lab., RJTF Construction Group, Tokyo, Japan

Ramjet Engine Test Facility (RJTF)

February 1998; 116p; In Japanese

Report No.(s): PB99--127748; NAL-TR-1347; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The National Aerospace Laboratory of Japan constructed a ramjet engine test facility (RJTF) at the Kakuda Research Center in 1994. It can duplicate engine test conditions in the range of flight Mach numbers from 4 to 8. The facility can supply non-vitiated air for M4 and M6 to identify the contamination effect in the vitiated air, to provide the basis for evaluating engine performance in the M8 flight condition. This paper outlines the unique features and operating characteristics of the RJTF. The quality of air stream obtained during facility calibration, and the facility-engine interaction are described. Finally we review tests oa an H2-fueled scramjet that are currently underway.

NTIS

Supersonic Combustion Ramjet Engines; Engine Tests; Wind Tunnel Tests; Supersonic Flow; Hydrogen Fuels; Supersonic Speed

19990036169 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA

Precision Runway Monitor (PRM) Baseline System Performance Characteristics Test Report

Dudas, Charles; Sep. 1998; 37p; In English

Report No.(s): AD-A360767; DOT/FAA/CT-TN98/17; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report documents the baseline performance characteristics of the Precision Runway Monitor (PRM) system as recorded during the various phases of the PRM test program. This report is a composite information from the various phases of the PRM test program. Based on participation in the PRM test program and a review of applicable test reports, ACT-310 has determined that the PRM system meets the PRM specification requirements for each of the identified 19 system performance characteristics. ACT-310 recommends no additional system performance testing of the PRM system is needed unless future design changes occur that may affect the baseline system performance characteristics.

DTIC

Runways; Specifications

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19990035801 Norwegian Defence Research Establishment, Kjeller, Norway

Mechanical Properties of ESSM Motor Case Material Candidates during Missile Flight

Berg, Jan Erik, Norwegian Defence Research Establishment, Norway; Olsen, Torbjorn, Norwegian Defence Research Establishment, Norway; Rysjedal, Jan Henning, Norwegian Defence Research Establishment, Norway; Dec. 22, 1998; 38p; In English

Contract(s)/Grant(s): FFIVM Proj. 750/174

Report No.(s): FFI/RAPPORT-98/06524; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The influence of aerodynamic heating and thermal degradation on bending stiffness EI for different material candidates for the ESSM rocket motor case have been checked by numerical analyses and mechanical tests. Special focus has been on three different carbon fiber reinforced plastic (CFRP) materials compared to the baseline steel quality of ESSM. If the assumption that the specified thermal environment in the ESSM Critical Item Development Specification apply to vertical surfaces of the missile, two of the three CFRP systems will have the same bending stiffness as steel for the full flight envelope of the missile. If the assumption is incorrect, the two CFRP systems will have the same bending stiffness as steel for the pressurized phase of the flight only.

Author

Aerodynamic Heating; Thermal Degradation; Mechanical Properties; Composite Materials; Bending; Stiffness; Missiles; Steels; Carbon Fiber Reinforced Plastics; Rocket Engine Cases

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19990035833 Cornell Univ., School of Civil and Environmental Engineering, Ithaca, NY USA

Crack Growth Simulation and Residual Strength Prediction in Airplane Fuselages ***Final Report***

Chen, Chuin–Shan, Cornell Univ., USA; Wawrzynek, Paul A., Cornell Univ., USA; Ingraffea, Anthony R., Cornell Univ., USA; Mar. 1999; 189p; In English

Contract(s)/Grant(s): NAG1-1184; RTOP 538-02-10-01

Report No.(s): NASA/CR-1999-209115; NAS 1.26:209115; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The objectives were to create a capability to simulate curvilinear crack growth and ductile tearing in aircraft fuselages subjected to widespread fatigue damage and to validate with tests. Analysis methodology and software program (FRANC3D/STAGS) developed herein allows engineers to maintain aging aircraft economically, while insuring continuous airworthiness, and to design more damage-tolerant aircraft for the next generation. Simulations of crack growth in fuselages were described. The crack tip opening angle (CTOA) fracture criterion, obtained from laboratory tests, was used to predict fracture behavior of fuselage panel tests. Geometrically nonlinear, elastic-plastic, thin shell finite element crack growth analyses were conducted. Comparisons of stress distributions, multiple stable crack growth history, and residual strength between measured and predicted results were made to assess the validity of the methodology. Incorporation of residual plastic deformations and tear strap failure was essential for accurate residual strength predictions. Issue related to predicting crack trajectory in fuselages were also discussed. A directional criterion, including T-stress and fracture toughness orthotropy, was developed. Curvilinear crack growth was simulated in coupon and fuselage panel tests. Both T-stress and fracture toughness orthotropy were essential to predict the observed crack paths. Flapping of fuselages were predicted. Measured and predicted results agreed reasonable well.

Derived from text

Crack Propagation; Residual Strength; Predictions; Fuselages; Computerized Simulation; Cracking (Fracturing)

19990036755 NASA Langley Research Center, Hampton, VA USA

Crashworthy Evaluation of a 1/5-Scale Model Composite Fuselage Concept

Jackson, Karen E., Army Research Lab., USA; Fasanella, Edwin L., Army Research Lab., USA; April 1999; 18p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 247-00-98

Report No.(s): NASA/TM-1999-209132; NAS 1.15:209132; ARL-MR-441; L-17835; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A 1/5-scale model composite fuselage concept for light aircraft and rotorcraft has been developed to satisfy structural and flight loads requirements and to satisfy design goals for improved crashworthiness. The 1/5-scale model fuselage consists of a relatively rigid upper section which forms the passenger cabin, a stiff structural floor, and an energy absorbing subfloor which is designed to limit impact forces during a crash event. The focus of the present paper is to describe the crashworthy evaluation of the fuselage concept through impact testing and finite element simulation using the nonlinear, explicit transient dynamic code, MSC/DYTRAN. The energy absorption behavior of two different subfloor configurations was determined through quasi-static crushing tests. For the dynamic evaluation, each subfloor configuration was incorporated into a 1/5-scale model fuselage section, which was impacted at 31 ft/s vertical velocity onto a rigid surface. The experimental data demonstrate that the fuselage section with a foam-filled subfloor configuration satisfied the impact design requirement. In addition, the fuselage section maintained excellent energy absorption behavior for a 31 ft/s vertical drop test with a 15 deg-roll impact attitude. Good correlation was obtained between the experimental data and analytical results for both impact conditions.

Author

Crashworthiness; Finite Element Method; Fuselages; Impact Tests; Scale Models; Structural Reliability; Crashes; Drop Tests; Applications Programs (Computers); Composite Materials

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19990036194 British Aerospace Public Ltd. Co., Military Aircraft Aerostructures, Brough, UK
Turbulent Boundary Layer Methods for Supersonic Flow
Cross, A. G. T., British Aerospace Public Ltd. Co., UK; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 3-1 - 3-30; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper considers the application of integral boundary layer theory to, turbulent, supersonic flow. Starting from the three-dimensional boundary layer equations the requirements for closure are addressed for the most general case. In particular, closure requires an accurate and consistent treatment of both the temperature and velocity profiles. Further, for supersonic flow the treatment must include an appropriate model for the effects of compressibility. It is shown how a consistent approach to closure can be achieved based on the law of the wall and wake velocity profile. This allows important Reynolds number and pressure gradient effects to be modelled. An important requirement for supersonic flow is the ability to model shock boundary layer interaction. For such flows involving wings the combined effects of Reynolds number and pressure gradient determine the limits and type of separation. Through application involving a viscous Euler calculation method, evidence is provided of the practical use of integral boundary layer methods based on the law of the wall and wake. This use includes application to wing flow involving three-dimensional shock boundary layer interaction.
Author
Three Dimensional Boundary Layer; Turbulent Boundary Layer; Boundary Layer Equations; Supersonic Flow; Mathematical Models; Boundary Layer Flow; Aerodynamic Configurations; Aircraft Design

19990036178 Air Force Research Lab., Propulsion Directorate, Wright-Patterson AFB, OH USA
Investigation of TESCOM Driveshaft Assembly Failure, *1 Apr. - 31 Oct. 1998*
Kenyon, James A.; Oct. 1998; 47p; In English
Contract(s)/Grant(s): Proj-3066
Report No.(s): AD-A360812; AFRL-PR-WP-TR-1998-2119; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the investigation into the failure of the driveshaft assembly during TESCOM compressor testing. The driveshaft assembly and compressor were disassembled and inspected, and data recorded during testing was played back and analyzed. This report provides details of the inspection and analysis. Results indicate that the driveshaft assembly failed as a result of an unpredicted shaft natural frequency in the operating range of the compressor. Recommendations are provided to reduce the possibility of such failures during future test programs.
DTIC
Compressors; Shafts (Machine Elements); Failure; Turbocompressors

19990036776 NASA Langley Research Center, Hampton,VA USA
X-33 (Rev-F) Aeroheating Results of Test 6770 in NASA Langley 20-Inch Mach 6 Air Tunnel
Berry, Scott A., NASA Langley Research Center, USA; Horvath, Thomas J., NASA Langley Research Center, USA; Kowalkowski, Matthew K., NASA Langley Research Center, USA; Liechty, Derek S., NASA Langley Research Center, USA; March 1999; 99p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 242-80-01-01
Report No.(s): NASA/TM-1999-209122; L-17824; NAS 1.15:209122; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Aeroheating characteristics of the X-33 Rev-F configuration have been experimentally examined in the Langley 20-Inch Mach 6 Air Tunnel (Test 6770). Global surface heat transfer distributions, surface streamline patterns, and shock shapes were measured on a 0.013-scale model at Mach 6 in air. Parametric variations include angles-of-attack of 20-deg, 30-deg, and 40-deg; Reynolds numbers based on model length of 0.9 to 4.9 million; and body-flap deflections of 10-deg and 20-deg. The effects of discrete roughness elements on boundary layer transition, which included trip height, size, and location, both on and off the wind-

ward centerline, were investigated. This document is intended to serve as a quick release of preliminary data to the X-33 program; analysis is limited to observations of the experimental trends in order to expedite dissemination.
Author
X-33 Reusable Launch Vehicle; Aerodynamic Heating; Aerodynamic Configurations; Wind Tunnel Tests; Hypersonic Speed; Heat Transfer; Boundary Layer Transition; Aerothermodynamics

13
GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19990036202 NASA Langley Research Center, Hampton, VA USA
Impact of Environmental Issues on the High-Speed Civil Transport
Whitehead, Allen H., Jr., NASA Langley Research Center, USA; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 12-1 - 12-25; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper provides an overview of the impact of environmental issues on the design and operation of the proposed High-Speed Civil Transport (HSCT). This proposal for a new generation commercial supersonic transport is being pursued by NASA and its U.S. industry partners in the NASA High-Speed Research (HSR) Program. The specific objectives herein are to address the four major barrier environmental issues and show their impact on the design of the airplane and potentially, its mode of operation. A brief historical perspective shows how HSR Phase 1 addressed these environmental topics and, with the successful completion of that program, led to the successful advocacy for the Phase 2 effort that followed. The Phase 2 program elements were discussed in the earlier paper and addressed technology programs to enhance the economic viability of the HSCT. Since many of the regulations that may effect the certification and operation of the HSCT are either not in place or well documented, a brief treatise is provided to address the status of the rules and the potential impact on the viability of the HSCT.
Author
Environment Effects; Supersonic Transports; Aircraft Design; Supersonic Aircraft

19990036472 South Dakota School of Mines and Technology, Rapid City, SD USA
Automatic Contrail Detection and Segmentation
Weiss, John M., South Dakota School of Mines and Technology, USA; Christopher, Sundar A., South Dakota School of Mines and Technology, USA; Welch, Ronald M., South Dakota School of Mines and Technology, USA; IEEE Transactions on Geoscience and Remote Sensing; September 1998; ISSN 0196-2892; Volume 36, No. 5, pp. 1609-1619; In English
Contract(s)/Grant(s): NAG5-2712; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Automatic contrail detection is of major importance in the study of the atmospheric effects of aviation. Due to the large volume of satellite imagery, selecting contrail images for study by hand is impractical and highly subject to human error. It is far better to have a system in place that will automatically evaluate an image to determine 1) whether it contains contrails and 2) where the contrails are located. Preliminary studies indicate that it is possible to automatically detect and locate contrails in Advanced Very High Resolution Radiometer (AVHRR) imagery with a high degree of confidence. Once contrails have been identified and localized in a satellite image, it is useful to segment the image into contrail versus noncontrail pixels. The ability to partition image pixels makes it possible to determine the optical properties of contrails, including optical thickness and particle size. In this paper, we describe a new technique for segmenting satellite images containing contrails. This method has good potential for creating a contrail climatology in an automated fashion. The majority of contrails are detected, rejecting clutter in the image, even cirrus streaks. Long, thin contrails are most easily detected. However, some contrails may be missed because they are curved, diffused over a large area, or present in short segments. Contrails average 2-3 km in width for the cases studied.
Author
Contrails; Segments; Climatology; Jet Aircraft; Remote Sensing

19990036473 South Dakota School of Mines and Technology, Inst. of Atmospheric Sciences, Rapid City, SD USA
Global Survey of Jet Contrails Using AVHRR Data: Spatial Distributions and Optical Property Retrievals
Kliche, Donna V., South Dakota School of Mines and Technology, USA; Chou, Joyce, South Dakota School of Mines and Technology, USA; Weiss, John M., South Dakota School of Mines and Technology, USA; Christopher, Sundar A., South Dakota School of Mines and Technology, USA; Welch, Ronald M., South Dakota School of Mines and Technology, USA; Berendes, Todd, South

Dakota School of Mines and Technology, USA; Kuo, Kwo–Sen, South Dakota School of Mines and Technology, USA; 1997, pp. 32-34; In English
Contract(s)/Grant(s): NAG5-2712; ISBN 0-7803-3836-7; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Global survey of jet contrails is of major importance in the study of the atmospheric effects of aviation. Jet contrails are considered to be a subset of thin cirrus clouds. Due to their semitransparent nature, thin cirrus clouds are thought to be enhances of the greenhouse effect: they are almost transparent to the incoming solar energy reaching the surface, and also they reduce the planetary emissions to space due to their cold temperatures. However, jet contrails are considered responsible not so much to increase cloudiness, but to enhance the formation of natural cloudiness. In the present study, one month of daytime global Advanced Very High Resolution Radiometer (AVHRR) data are used to 1) automatically detect contrails, 2) estimate the global frequency of occurrence of contrails, and 3) estimate the optical depth and particle size of jet contrails.
Author
Advanced Very High Resolution Radiometer; Surveys; Contrails; Spatial Distribution; Optical Properties; Jet Aircraft

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19990036746 Army Aeromedical Research Lab., Fort Rucker, AL USA
Heat Stress Evaluation of Special Operations Aviation Regiment and Air Warrior Concept 1 and 3 Aviator Ensembles in a UH-60 Simulator ***Final Report***
Reardon, Matthew J.; Katz, Lawrence; Frazer, Beth; Mar. 1999; 76p; In English
Contract(s)/Grant(s): Proj-30162787A879
Report No.(s): AD-A361526; USAARL-99-07; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This aviator heat stress study used a mixed between/within test subject design with one environmental condition (hot) and three rotary-wing MOPP4 ensembles (Special Operations Aviation Regiment SOAR), Air Warrior Concept 1, and Air Warrior Concept 3) encumbered with ballistic protection and over-water survival components. The SOAR ensemble was tested with (SC) and without (SX) microclimate cooling (MCC) consisting of a water-cooled undershirt with portable refrigerator/pump. Air Warrior Concept 1 and Concept 3 aviator MOPP4 ensembles were tested with (AC) and without (AX) MCC, respectively. Physiological and subjective data were obtained to compare thermoregulatory responses and quantitate the benefits of microclimate cooling. Test sessions consisted of a 20-minute treadmill walk in a heated (100 deg F and 20 percent relative humidity RH) environmental chamber to stimulate outdoor preflight activities, followed by three 2-hour sorties in a research UH-60 simulator with cockpit conditions set at 1000 F and 50 percent RH (90 deg F wet-bulb globe temperature WBGT).
DTIC
Atmospheric Temperature; Microclimatology; Liquid Cooling; Heat Tolerance; Cockpits; Aircraft Pilots

19990032483 Defence Evaluation Research Agency, Aircraft Test and Evaluation, Boscombe Down, UK
Application of an Anthropometric Tool to Cockpit Layout
Burrett, Gretchen, Defence Evaluation Research Agency, UK; A Designer's Guide to Human Performance Modelling; December 1998, pp. A3-1 - A3-4; In English; See also 19990032479; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

Anthropometric tools are used to assess human interaction with workplace layout in terms of fit, reach and vision. As humans do not come in a standard size, these tools address the range of potential users, from very small to very large. This paper provides an example of how Anthropometric tools can be used to help optimise cockpit layout. Jack(R) is used as an example tool.
Author
Anthropometry; Cockpits; Optimization; Computer Aided Design

19990036747 Army Aeromedical Research Lab., Fort Rucker, AL USA
Female Hairstyle and Flight Helmet Accommodation: The AMELIA Project. Phase1: Survey Study. Part 2: Survey Responses ***Final Report***
McEntire, B. J.; Murphy, Barbara A.; Mozo, Ben T.; Mar. 1999; 82p; In English
Contract(s)/Grant(s): Proj-30162787A878
Report No.(s): AD-A361528; USAARL-99-10; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Most personal protective equipment in current military aviation was designed with male aircrew in mind. to ensure that female aviator performance is not hampered by improperly fitted or sized equipment, the U.S. Navy (USN) established the Aircrew Modified Equipment Leading to Increased Accommodation (AMELIA) program. In this Phase 1 study, a novel questionnaire was dis-

tributed to a variety of USN and U.S. Marine Corps (USMC) aviation installations around the world to assess the effect of female hairstyles on flight helmet performance and safety. One hundred and one completed questionnaires were returned to the U.S. Army Aeromedical Research Laboratory (USARRL) resulting in a response rate of 21-40%.
DTIC
Aircraft Pilots; Females; Flight Characteristics; Flight Crews; Helmets

19990036748 Army Aeromedical Research Lab., Fort Rucker, AL USA
Female Hairstyle and Flight Helmet Accommodation: The AMELIA Project. Phase I: Survey Study. Part 1: Research Report ***Final Report***
McEntire, B. J.; Murphy, Barbara A.; Mozo, Ben T.; Crowley, John S.; Mar. 1999; 54p; In English
Contract(s)/Grant(s): Proj-30162787A878
Report No.(s): AD-A361529; USAARL-99-09; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Most personal protective equipment in current military aviation was designed with male aircrew in mind. to ensure that female aviator performance is not hampered by improperly fitted or sized equipment, the U.S. Navy (USN) established the Aircrew Modified Equipment Leading to Increased Accommodation (AMELIA) program. In this Phase I study, a novel questionnaire was distributed to a variety of USN and U.S. Marine Corps (USMC) aviation installations around the world to assess the effect of female hairstyles on flight helmet performance and safety. One hundred and one completed questionnaires were returned to the U.S. Army Aeromedical Research Laboratory (USAARL) resulting in a response rate of 21-40%.
DTIC
Females; Helmets; Flight Crews; Flight Characteristics

16
PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19990035992 National Aerospace Lab., Tokyo, Japan
Study of Turbulence Spectra Measurement Technique Using an LDV
Gomi, M., National Aerospace Lab., Japan; Takeda, T., National Aerospace Lab., Japan; Kobayashi, H., National Aerospace Lab., Japan; January 1998; 20p; In Japanese
Report No.(s): PB99--127730; NAL-TR-1346; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A nondisturbance technique of measuring turbulent velocity spectra was studied to clarify the source of aerodynamic noise. In an anechoic wind tunnel, the continuous spectra of turbulent velocity in the wake of a cylinder of 10 mm diameter was measured over a range of mean velocity 30 - 50 m/s using an optical fiber-linked LDV probe of 160 mm focal length. Accurate measurements of turbulence spectra due to Karman vortices were obtained by data sampling at 20 45KHz for 10,000 samples at a measuring point. A smoke generator (ROSCO Co.) was very useful for producing the seeding particles. Sound pressure spectra were measured and compared with the discrete frequency of the turbulent velocity.
NTIS
Laser Doppler Velocimeters; Aerodynamic Noise; Turbulent Wakes; Velocity Measurement; Wind Tunnel Tests; Continuous Spectra

19990036197 Colorado Univ., Aerospace Engineering Sciences, Boulder, CO USA
Sonic Boom Minimization
Seebass, Richard, Colorado Univ., USA; Fluid Dynamics Research on Supersonic Aircraft; November 1998, pp. 6-1 - 6-13; In English; See also 19990036191; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

We revisit the classical Jones-Seebass-George-Darden theory of sonic boom minimization, noting that minimum achievable sonic boom is related to the aircraft's weight divided by the three-halves power of its length. We then summarize studies of sonic boom acceptability and the effects of vibrational relaxation on very weak shock waves. This leads us to conclude that a small, appropriately designed, supersonic business jet's sonic boom may be nearly inaudible outdoors and hardly discernible indoors. It is important to note at the outset that any improvement in the traditional parameters that govern the efficiency of the aircraft that result in a reduction of the aircraft's weight also provide, thereby, a reduction in sonic boom overpressure and impulse. Improvements in the lift-to-drag ratio, the thrust-to-weight ratio, the specific fuel consumption and the structural efficiency can all result in sonic boom reductions for an aircraft with the same range. Conversely, aerodynamic changes that appear to reduce

the sonic boom but that compromise any of these traditional figures of merit will probably increase the sonic boom. One of the primary difficulties in this field has been knowing what is to be reduced or minimized in order to make the sonic boom acceptable. Here we know much more than we did twenty-five years ago. As it is experienced outdoors, the most annoying feature of the sonic boom is the shock wave that gives rise to the more descriptive appellation used in Europe, "sonic bang." For small aircraft this may be principal parameter for sonic boom annoyance and loudness, indoors or outdoors. For large aircraft, when the sonic boom is experienced indoors, another significant parameter is undoubtedly the energy in the signature as a function of frequency, perhaps adequately characterized by the overpressure and the impulse of the signature. The impulse is the integral of the pressure with time over that period of time during which the pressure is positive. For commercial transport-size aircraft the impulse is also a significant parameter in studies of structural disturbances due to, and the indoor loudness and annoyance from, sonic booms.
Author
Sonic Booms; Supersonic Jet Flow; Commercial Aircraft; Supersonic Commercial Air Transport; Supersonic Aircraft; Supersonic Flight; Noise Reduction

19990036497 Department of Energy, Office of Energy Research, Washington, DC USA
Effect of inlet conditions on the performance of a palladium membrane reactor
Birdsell, S. A., Department of Energy, USA; Willms, R. S., Department of Energy, USA; Arzu, P., Department of Energy, USA; Costello, A., Department of Energy, USA; Oct. 31, 1997; 5p; In English; 17th; Fusion engineering, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE98-004355; LA-UR-97-4935; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Palladium membrane reactors (PMR) will be used to remove tritium and other hydrogen isotopes from impurities, such as tritiated methane and tritiated water, in the exhaust of the International Thermonuclear Experimental Reactor. In addition to fusion-fuel processing, the PMR system can be used to recover tritium from tritiated waste water. This paper investigates the effect of inlet conditions on the performance of a PMR. A set of experiments were run to determine, independently, the effect of inlet compositions and residence time on performance. Also, the experiments were designed to determine if the injected form of hydrogen (CH4 or H2O) effects performance. Results show that the PMR operates at optimal hydrogen recovery with a broad range of inlet compositions and performance is shown to increase with increased residence time. PMR performance is shown to be independent of whether hydrogen is injected in the form of CH4 or H2O.
NTIS
Palladium; Membranes; Engine Inlets; Chemical Reactors; Waste Treatment

18
SPACE SCIENCES

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In the past, measurements onboard a research Boeing 57F (RB57-F) aircraft have demonstrated that the neutron environment within the aircraft structure is greater than that in the local external environment. Recent studies onboard Boeing 737 commercial flights have demonstrated cabin variations in radiation exposure up to 30 percent. These prior results were the basis of the present study to quantify the potential effects of aircraft construction materials on the internal exposures of the crew and passengers. The present study constitutes preflight measurements using an unmoderated Cf-252 fission neutron source to quantify the effects of three current and potential aircraft materials (aluminum, titanium, and graphite-epoxy composite) on the fast neutron flux. Conclusions about the effectiveness of the three selected materials for radiation shielding must wait until testing in the atmosphere is complete; however, it is clear that for shielding low-energy neutrons, the composite material is an improved shielding material over aluminum or titanium.
Author
Radiation Shielding; Aircraft Structures; Aircraft Construction Materials; Ionizing Radiation; Flight Tests

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